DOCUMENT RESUME

ED 083 457 CE 000 478

AUTHOR McKinlay, Donald Bruce
TITLE A Functional Classification of Occupations.
PUB DATE Jun 71
NOTE 303p.; Ph.D. Dissertation, University of Oregon
AVAILABLE FROM University Microfilms, 300 N. Zeeb Rd., Ann Arbor, Michigan 48103 (MF $4.00, Xerography $10.00)

EDRS PRICE MF-$0.65 HC-$13.16
DESCRIPTORS *Classification; Cluster Grouping; Data Collection; Data Processing; Doctoral Theses; *Function Words; Manpower Development; *Occupational Clusters; *Occupational Information; Occupations; Systems Analysis

ABSTRACT

The need for more and better manpower information is hampered by the lack of adequate occupational data classification systems. The diversity of interests in occupations probably accounts for the absence of consensus regarding either the general outlines or the specific details of a standardized occupational classification system which would reduce the cost of generating data and enhance communication. Neither extreme accuracy nor precise detail are necessary but a system of classification based on principles is essential. Existing classification systems reviewed are the socio-economic, worker traits, and curriculum areas types. "Function" as a underlying principle has conceptual, operational, and analytical advantages which are described in detail. (MS)

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A FUNCTIONAL CLASSIFICATION OF OCCUPATIONS

by

DONALD BRUCE McKINLAY

A DISSERTATION

Presented to the Department of Economics
and the Graduate School of the University of Oregon
in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

June 1971

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CHAPTER I

THE LACK OF ADEQUATE OCCUPATIONAL DATA CLASSIFICATION SYSTEMS

Introduction

One of the most significant developments of the last decade in applied economics is the reactivation of serious concern about occupational and other structural disequilibria in the labor market, the initiation of positive manpower policies and sizeable manpower programs, and the emergence of "manpower" as a field of economic and social inquiry, policy, and program operation. It is axiomatic to the scientific method that information is a prerequisite to policy and program planning, and both popular and professional literature are replete with prescriptive statements concerning the need for more and better manpower information. Most frequently the need articulated by these statements is a need for occupational information.

> The first requirement for an orderly labor market and satisfactory adjustment to change is adequate information. Alternative employment opportunities are real to the individual only if he is aware of their existence. Displaced

workers, those vulnerable to displacement, and those who want to improve their standing in the labor market can make reasonably appropriate decisions only if they have information, not only about present opportunities but about the future outlook for alternative occupations.

The job seeker, whether unemployed or seeking better employment, has little information available concerning alternative job openings.[1]

The individual labor force participant's information needs

. . . may be both short term and long term. His immediate requirement is information concerning job opportunities in the relevant labor market.

. . . .

For the employed worker the basic question involves the availability of other jobs that will offer the maximum development and utilization of his abilities.[2]

The young person entering the labor market for the first time has an immense number of potential employers, scarce as they may seem the first day. If he is an unskilled or a semiskilled worker, the number of potential employers is strictly in the millions. Even if he has a specialized training, the number of potential employers will be in the thousands. . . .

No worker, unless his degree of specialization is pathological, will ever be able to become informed on the prospective earnings which would be obtained from every one of these potential employers at a given time, let alone keep this information up to date. He faces the problem of how to acquire

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[1] National Commission on Technology, Automation, and Economic Progress, *Technology and the American Economy*, Vol. I (Washington: United States Government Printing Office, 1966), p. 49.

[2] Advisory Committee on Research to the U.S. Employment Service, *Labor Market Information and the Federal-State Employment Service System* (Washington, D.C., February, 1968), pp. 1-2.

> information on the wage rates, stability of employment, conditions of employment, and other determinants of job choice, and how to keep this information current.[3]

Both workers and employers have capital value in information, which Stigler attempts to specify in his article, "From the social viewpoint," he says, "the return from investment in information consists in a more efficient allocation of the labor force: the better informed the labor market, the closer each worker's (marginal) product is to its maximum at any given time."[4]

> For vocational guidance, generalized information is needed on the extent of employment opportunities in the future, together with information on working conditions, the nature of the work and how one trains and qualifies for employment.[5]

As Goldstein suggests, such individualized needs have their complements in program planning and in broader-scale economic analysis and planning.

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[3] George J. Stigler, "Information in the Labor Market," Journal of Political Economy, LXX, No. 5, Part 2 (Supplement: October, 1962), p. 94.

[4] Ibid., p. 104.

[5] Harold Goldstein, "Introductory Statement on the B. L. S. Program" in Long-Term Manpower Projections, Proceedings of a Conference Conducted by the Research Program on Unemployment and the American Economy, ed. by R.A. Gordon (Berkeley, California: University of California, Institute of Industrial Relations, 1965), p. 5.

> programmes, restrictions on the call-up of men for military service, etc.
>
> Projections of occupational supply and requirement have also been used in mobilization planning in the testing of the feasibility of specific mobilization programmes in terms of manpower supply . . . help evaluate the manpower feasibility of launching new, large-scale governmental programmes such as space or mental health . . . evaluating the feasibility or the implications of attaining certain standards of service, for example, reducing the pupil-teacher ratio in secondary schools.[8]
>
> Occupational statistics are increasingly needed to evaluate the impact of automation and technological change on the structure of the economy.[9]

The statement of the National Manpower Council regarding the need for adequate knowledge is worth quoting at some length.

> In spite of the enormous strides taken in the past two decades in manpower research and in the collection and analysis of relevant data, the field of manpower study is still marked by vast stretches of terra incognita awaiting

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[8] Harold Goldstein and Sol Swerdloff, Methods of Long-Term Projection of Requirements for and Supply of Qualified Manpower (Paris: United Nations Educational Scientific and Cultural Organization, 1967), p. 29.

[9] President's Committee to Appraise Employment and Unemployment Statistics, Measuring Employment and Unemployment (Washington, D. C.: U.S. Government Printing Office, September, 1962), p. 26.

exploration. Much of the data essential for a better grasp of certain problems, the testing out of hypotheses, and the construction of systematic theory are still lacking. The same situation holds for such separate but related fields of study as education, occupational choice and counseling, health, and the economic and social consequences of technological change. All of these contribute essential knowledge to the understanding of the manpower processes and problems.

Lack of information and understanding have repeatedly proved serious impediments to sound policy decisions. This is not to say that decisions should be suspended until a manpower problem has been exhaustively investigated and alternative policies designed for its solution are assessed with equal thoroughness. Such a course would be an invitation to inaction; it neither can nor should be pursued in a dynamic society. Mortal men, compelled to do as well as they can with the knowledge they possess, frequently have no choice but to act upon their ignorance.

Yet, it is quite clear that some manpower policies and programs adopted with enthusiasm in the recent past might have been regarded differently had a richer store of relevant knowledge been available.

Because of its importance to the proper assessment of manpower problems and sound policy-making, improved knowledge about manpower development and utilization has been a consistent theme in the recommendations made by the National Manpower Council. It has called upon academic institutions, the foundations, business, labor, and government to engage in or support studies on a variety of subjects. These range from "the process of occupational choice" to "the impact of the increased employment of women upon family life, the rearing of children, and the self-development of women"; from "the factors facilitating the development of talent and superior ability" to the long-range

> More and better occupational data are sorely needed in the planning and development of curricula for education at many levels in the schools and colleges. And parallel to this are similar needs for government-sponsored training programs under such acts as the Manpower Development and Training Act. It is important that we take every precaution that we are training students and workers for jobs which will be needed in our economy.[6]

Other major needs for occupational information are identified in the following quotations.

> Occupational labor market information is basic to the public employment office function of matching workers and jobs. It is an important tool for improving local office service to workers and employers. It is essential for identifying specific shortage occupations and job openings for which the unemployed and the underemployed can be trained under the provision of recent national legislation. It focuses attention upon occupational trends and available worker skills essential for community development. It provides the framework within which the many-storied structure of occupational choice, training, job placement, and personal satisfaction may be built.[7]

> Decisions on many policies are influenced by an appraisal of the adequacy of the present and prospective supply of technical manpower. Policies must be set by industry and by government with respect to such matters as recruitment, development of technicians and other supporting workers, salaries, scholarships, plans for expansion of research

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[6] Carl Baird, Robert Halbeisen, and John Kaarsberg, "Improving Occupational Statistics," Employment Security Review, XXX, No. 2 (February, 1963), p. 7.

[7] Bureau of Employment Security, "Analyzing the Labor Market" in Employment Security Review, XXX, No. 6 (June, 1963), p. 62.

manpower requirements of local, state, and Federal governments.[10]

The above sampling of comments on the increasing need for occupational data could be extended almost indefinitely. Such a cataloguing would only further demonstrate the obvious but ill defined proposition that marginal returns to information in decision making are widely viewed as positive throughout a substantial range.

Despite the potential importance of occupational data and the Government's interest in them, little effort has been made by academic economists to examine the conceptual basis of the occupational classification system or to suggest modifications in the light of their own objectives.[11]

In fact, as Stigler observes in his classic article on the economics of information, the whole subject of information has largely been ignored (or assumed away) in economics.[12]

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[10] National Manpower Council, Manpower Policies for a Democratic Society (New York: Columbia University Press, 1965), pp. 96-97, 98. See also the various statements of Council on its studies and the Proceedings of the Arden House conferences in which the need for more adequate knowledge and problems inviting research were constant themes.

[11] Glen Cain, W. Lee Hansen, and Burton A. Weisbrod, "Occupational Classification: An Economic Approach" Monthly Labor Review, XC, No. 2 (February, 1967), p. 48.

The concern with occupational problems and consequently the demand for occupational data arises largely because of the occupational consequences of economic change. There are, of course, many causes of occupational change.

> Technological change is the most often discussed and is one of the most significant of these, but occupational changes can also be affected by institutional factors--for example, union-management relationships and practices, as in the case of the railroad industry. They may be affected by the relative supply in the different occupations--for example, the substitution effect resulting from shortages of one occupation (such as engineers) and their replacement by members of a second occupation (such as technicians). They may be affected by changes in the scale of operations--the number of overhead personnel, for example, is less flexible than is the number of production or operating workers as the total scale of operations rises or falls. And, changes in total demand for workers in each occupation also reflect shifts in market demand for the products of each industry, as affected by changes in the level and the distribution of income among consumers, industry and government, and changing patterns of consumption. Thus, to analyze the changing occupational requirements of the economy one must study a great many subjects besides technological developments.[13]

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[12] George J. Stigler, "The Economics of Information" Journal of Political Economy, LXIX, No. 3 (June, 1961), p. 213.

[13] Cora E. Taylor, "Employment Projections by Occupation," in Long-Term Manpower Projections, Proceedings of a Conference Conducted by the Research Program on Unemployment and the American Economy, ed. by R.A. Gordon, (University of California, Berkeley: Institute of Industrial Relations, 1965), p. 37.

Not only are there numerous causes of occupational changes but these causes are inexorably intertwined.

> In the field of manpower forecasting there is no means of defining exactly what is meant by one process as distinguished from another. The process chains divide and meet again over time, they are linked together in an intricate and everchanging pattern; presumably no single process is completely independent of any of the others.[14]

Garth Mangum notes the subtlety of economic change with yet another analogy.

> Economic revolutions are usually quiet revolutions. There are few inflammatory speeches; there is no waving of flags, or the sound of gunfire in the streets. There is no obvious event with which the revolution started or climax at which it is completed. Yet as one looks back from the perspective of time, it is apparent that the fabric of society has undergone an alteration more profound than any military action could have accomplished. Indeed, it is a commonplace of history, though one not often noted, that political revolutions rarely affect basic changes in society. Basic economic changes always do.[15]

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[14] Sten-Olof Döös, "Long-Term Employment Forecasting, Some Problems with Special Reference to Current Organisation and Methods in Sweden" in Employment Forecasting, Final Report of International Seminar on Employment Forecasting Techniques (n.p.: Organisation for Economic Co-operation and Development, [illegible]), p. 47.

[15] Introduction by Garth L. Mangum, The Manpower Revolution: Its Policy Consequences (Garden City, N.Y.: Doubleday and Company, Inc., 1965), p. xiii.

Despite the importance of such issues, the intent of this research is not to explore the extent to which automation is revolutionary nor to join the debate between the "structuralists" and the "aggregate demand advocates" which raged during the high unemployment years of the early 1960's over the causes of unemployment.

Mechanization and other causes of economic change are most often matters of public concern principally because they often lead to dislocations in the labor market, both at an aggregate, output-per-man level and at a detailed, occupational surplus and shortage level. Thus, while the study of basic causes of economic change is important for analytical and policy purposes, detailed analyses of the manpower consequences of such changes are important for policy and program. The purpose here is to evaluate the efficacy of various occupational classification systems as ingredients in the meaningful evaluation of manpower effects of economic change, rather than the analysis of the economics of managerial decisions as they relate to technological, organizational, market and other changes.

At present, one of the major impediments to meaningful evaluation of the manpower effects of economic change is the lack of consistent terminology and an analytically useful classification system. A recent Monthly Labor Review article begins,

> If there is to be systematic and continued attention to resolving unemployment and job vacancy problems, the improvement of occupational coding is required by manpower planners, training agencies, government agencies, and manpower analysts.[16]

In speaking about one of the prime users of occupational information, John Shea notes the problems now encountered in trying to interpret manpower data for vocational education purposes.

> Occupational classification schemes constitute one of the first difficulties encountered in translating manpower requirements by occupation into functional "skill demands" or "education and training requirements."[17]

It is apparent that there is substantial agreement on the need for more information about occupations and about the manpower consequences of basic economic changes. Effective utilization of present or additional information, however, requires conceptually, operationally, and analytically useful data classification systems.

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[16] Eleanor G. Gilpatrick, "A Proposed System of Occupational Coding," Monthly Labor Review, XCI, No. 10 (October, 1968), p. 47.

[17] John R. Shea, "Occupational Education and Training Requirements: Relationships Essential for Planning State Vocational Education" in Manpower Information for Vocational Education Planning, A Conference Report, edited by Robert C. Young (Columbus, Ohio: Center for Vocational and Technical Education, The Ohio State University, November, 1969), p. 76.

Lack of Standard Occupational Classification System

Unfortunately there has been no consensus regarding either the general outlines or the specific details of a standardized occupational classification system, despite frequent suggestions that such a system be developed. There are a half-dozen or more systems which are both comprehensive and exhaustive, but very few of them are used for classifying data. There are at least a dozen others which provide a general framework into which detailed occupations could be fitted, but for which the latter step has not been taken.

Several reasons can be found for the present, confusing array of classification schemes. Probably the major reason is the diversity of interests in occupational matters. So many personal traits are involved in a person's relationship to employment, and a person's occupation is so important in conditioning other aspects of his social and economic life, that several of the social sciences have major interests in information about occupations. Psychologists are interested in occupations because ey have found that the occupation in which a person works relates gnificantly to both his interests and aptitudes. Sociologists have nd occupations to be a prime indicator of social status. Economists use occupational data to analyze differences in levels of onomic development and personal income, and for studying bility, the structure of compensation, the impact of technological hange, and other analytical issues, as well as for manpower planning.

> The amounts and kinds of information needed for the efficient allocation of labor, whether judged from the viewpoint of the laborer, the employer, or the community, extend far beyond the determination of wage rates. The kinds and amounts of skill men should acquire pose parallel informational problems, and so too do the non-monetary conditions of employment. The traditional literature has not done these problems justice. It is doubtful that justice would be more closely approached by making exaggerated claims of the importance of the problem of information. There is no exaggeration however, in the suggestion that the analysis of the precise problems in information and of the methods an economy uses to deal with them appears to be a highly rewarding area for future research.[18]

The analytical power of occupational data has utility in a broad range of economic research. Though tradition and the availability of consistent and reliable data have predisposed economists to deal with industry data, many significant economic

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[18] Stigler, "Information in the Labor Market," p. 104.

[illegible] could be better studied by means of occupational data, if those were classified in analytically useful ways.

In addition to the research interests in occupations, the recent [illegible] concern for manpower problems has focused greatly increased attention on occupational matters. In the program area, the emerging field of "manpower policy" concerns itself with the reconciliation of occupational demand and supply within the broader interests of general economic policy. Another major use of occupational information is in vocational counseling, where interest and aptitude factors come into play, in addition to the supply and demand data. Vocational education and manpower training at all levels are receiving increasing emphasis as tools for reconciling imbalances in the labor market, and the planning of such programs requires information about the supply and demand of occupational skills at various levels of proficiency. Job placement is yet another function which requires occupational information. Industrial location and the setting of wage scales also depend, in varying degrees, on occupational data. So, in addition to the specific needs of economic, sociological, psychological, and educational research, there is an increasing program need for information about occupations. The breadth of interest in occupations has made it difficult to agree upon a single

...ation system.

...ld conclude that a single classification system is ...ssible of construction. In his article about occupational ...ation systems in the United States, James Scoville ... that, "To be useful, data must be constructed with their ... clearly in mind. Data assembled for analysis of one ... may have very low transfer value to consideration of a ... problem."[19] Scoville goes on to describe the analytical ... which prompted the official occupational classification ... used in this country and to criticize the relevance of those ... to present issues. Discussing the same issue elsewhere, ... that ". . . a new method of arranging the data is a ... requirement for the study of new problems."[20]

... referring to the socio-economic classification systems ... U.S. Government agencies, Paul Hatt observes that,

> ... apply a classification to a totally different problem ... the one for which it was intended is always a dangerous

---

[19] ...mes Scoville, "The Development and Relevance of U.S. ... Data," Industrial and Labor Relations Review, XIX, ...ber, 1965), p. 70.

[20] ...s G. Scoville, "Making Occupational Statistics More ... American Statistical Association, Proceedings of the ... Economic Statistics Section, 1965, p. 319.

> and frequently an unhappy undertaking all too often found in the use of occupational indexes in [social] stratification studies.[21]

The fine points of classification are often crucial to research, when they are of less significance in program planning and operation; therefore one might expect to hear criticism from researchers but not from persons principally concerned with the operation of manpower programs. Such is not the case, however. Persons who are principally concerned with vocational counseling and with occupational education appear to be at least as dissatisfied with the widely used socio-economic systems as the researchers quoted above. The numerous systems which propose to classify occupations on the basis of characteristics of the workers rather than job duties illustrate this dissatisfaction among counselors, and the vocational educators' insistence upon talking in terms of "job clusters" requiring similar educational inputs reveal the dissatisfaction on their part.

Compounding the problem presented by the diverse interests [illegible] ations is the increasing differentiation of occupations themselves and the consequent increase in the number of separate, identifiable types. The vast increase in the division of labor over the past couple of centuries has tended to replace the "all-around" craftsmen, tradesmen, and farmers with highly specialized production and service personnel. Even within such a speciality as economics, for instance, there are several fields of special competence, and among welders there are eight identifiable types, according to the Dictionary of Occupational Titles (D. O. T.). That catalog of occupations defines 21,741 separate occupations which go by 35,550 different titles.[22]

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[21] Paul K. Hatt, "Occupation and Social Stratification," *American Journal of Sociology*, LV, No. 6 (1950), p. 533.

Yet there is some sentiment to the effect that even this level of detail is inadequate. John Myers points out, with reference to the D. O. T., that some specialities, such as entry occupations, may be concealed in the D. O. T. Groups.[23] This example illustrates one of the factors that has led to the development of such lengthy lists of occupations--the inclination to employ more than one dimension in constructing a relatively detailed occupational listing.[24]

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[22] U.S. Department of Labor, Bureau of Employment Security, Dictionary of Occupational Titles 3rd ed. (Washington, D. C.: U.S. Government Printing Office, 1965), I, xv.

[23] John G. Myers, "Conceptual and Measurement Problems in Job Vacancies: A Progress Report on the N. I. C. B. Study," The Measurement and Interpretation of Job Vacancies, A Conference Report of the National Bureau of Economic Research (New York: National Bureau of Economic Research, 1966).

The potential for identifying occupational differences, which the D. O. T. reveals, presents yet another problem for the construction of an occupational classification system. Even though it may be possible to define twenty-two thousand or more different occupations, it is wholly impractical to expect to provide statistically reliable content to that many categories, even in such elementary terms as current employment, let alone such other terms as forecasts of job openings, personal characteristics of the incumbents, hiring requirements, sources of manpower supply, and the like. A very detailed classification system, when it is cross-classified with some other variable, quickly runs out of items per cell; thus unless it contains complete data, its accuracy becomes very limited.[25] Glen Cain, Lee Hansen, and Burton

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[24] In this instance, both job duties and experience requirements are being suggested as criteria for defining occupations. More examples of the use of multiple classification criteria are discussed in the section dealing with socio-economic classification systems.

[25] See Oskar Morgenstern, On the Accuracy of Economic Observations, 2nd ed. (Princeton, N. J.: Princeton University Press, 1963), especially Chapter 2.

Weisbrod rightly point out that,

> Occupational categories should be presented at a level of detail that pays heed to the costs of obtaining it. In short, there is a level that balances the benefits of additional detail--information that would enable workers to pick jobs more suitable to their skills and preferences, and that would permit employers to select more easily workers with the desired skills--against the costs of obtaining the additional detail.[26]

Although in a different context, the issue here is akin to some of the issues raised in the famous dialogue about "empty economic boxes," which occupied the pages of The Economic Journal in 1922.[27]

Practical limitations on the resources available for occupational data development preclude quantifying anything like twenty-two thousand occupations; moreover, that number of categories is so large as to be far beyond the limits of even a specialist's comprehensive knowledge. Of all the uses for occupational data, vocational counseling is one of the most particularized, yet having to consider each detailed occupation would make the "task of helping an individual find a suitable occupation . . . impossibly difficult."[28]

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[26] Glen Cain, W. Lee Hansen, and Burton A. Weisbrod, "Occupational Classification: An Economic Approach," p. 52.

[27] See J. H. Clapham, "Of Empty Economic Boxes," The Economic Journal, Vol. XXXII (1922), pp. 305-314, and A. C. Pigou, "Empty Economic Boxes: A Reply," The Economic Journal, Vol. XXXII (1922), pp. 458-465.

Thus, it becomes apparent that some grouping of the detailed categories--some classification scheme--is required, not only to make the collection of information feasible, but also to make knowledge of occupations comprehensible. Grouping of occupations may be more appropriate for these reasons than for any inherent similarity in the nature of jobs themselves.

Supposing one agrees to the usefulness of occupational grouping, and most writers in vocational curriculum planning, sociology of occupations, manpower economics, etc., seem to, there is still little agreement as to the variable upon which the classification is to be based, and only implicit reference to the number of groups which would be appropriate. The problem at hand therefore, is broadened from defining the desirable classification scheme to determining the most appropriate level of detail.

With regard to the latter question, it already has been suggested that the greatest level of detail permitted by our research capabilities is much less than the twenty-two thousand items in the D.O.T. An additional consideration is the rule that the level of detail employed in a classification system must be conditioned by the degree of detail existing in the information to be classified. Whether occupational data are gathered from individual workers or from employing establishments, the task of translating what are frequently imprecise titles is difficult, and the classification process is complicated by the surprisingly large number of uncommon jobs to be found in the labor market. In considering the classification of such data, "It should be noted at once that no amount of elaboration in a classification scheme can make up for deficiencies in the original material collected."[29]

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[28] Leona E. Tyler, The Psychology of Human Differences, 3rd ed. (New York: Appleton-Century-Crofts, 1965), p. 198.

> Any evaluation of occupational statistics must therefore take into account not only legitimate differences in point of view with regard to the criterion of measurement and the kind of classification to be used, but, in addition, must recognize that the reliability of all data is affected by the absence of a standardized terminology for describing occupational phenomena.[30]

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[29] Gladys L. Palmer, "Some Considerations Involved in Appraising the Adequacy of Occupational Statistics," Journal of the American Statistical Association, XXXVI, No. 213 (1941), p. 67.

[30] Ibid., p. 69.

From a research point of view, it seems likely that the practical limit is more like several hundred than several thousand. The U.S. Census of Population, which provides employment data for the population, does so for only 297 detailed occupations. Even the D.O.T. itself, when it attempts to specify certain characteristic requirements of occupations, groups them into 114 groups.

Moreover, it may be that the potential for detail existing in present research capability is not the limiting factor, but that we are already capable of describing more types of occupations than anyone has any interest in knowing about. Thus, it will be appropriate to inquire into the level of detail desired by the various users of occupational data as well as into the variables they consider most important and the classification system they find most useful.

A final word is in order about the desirability of attempting to standardize occupational classifications. The great diversity of interest in occupations and the differentiation of occupations themselves seem to suggest that a universally applicable system may be hard to attain. Despite the very real problems, there are strong arguments in favor of attempting to find some common denominator on which all major users can agree. The Weber Committee, in their report on Labor Market Information and the

Federal-State Employment Service System, described a standard classification as a necessary precondition to an ideal labor market information system.[31] Probably the most compelling argument emerges from the practical fact that collecting and classifying data is both costly and difficult. Considerable resources and expertise, expended in a continuing effort, are required to accomplish the task. It is probably significant that only large, public agencies have so far developed systems that can claim to be exhaustive. Therefore it seems highly inefficient to leave each user of occupational data to his own devices in classifying data.

Also favoring a standardized system is the need for communication between research groups and program personnel, a need which is especially great in the manpower field. Both at the policy level and the operating level, understanding of manpower problems and the evaluation of program effectiveness is facilitated by common terminology. The problem inherent in the acceptance of multiple classification systems was noted by the International Labor Office in the introduction to their own classification manual.

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[31] Advisory Committee on Research to the U.S. Employment Service, Labor Market Information and the Federal-State Employment Service System, p. 5.

> Many countries maintain two or more separate national occupational classifications; in some cases it is frankly admitted that the classifications have developed independently, while in others it is argued that different methods of classification are needed to attain different objectives. Still, whatever the reason given, it is evident that the existence of several systems side by side seriously complicates the task of administrators and others correlating occupational data from different sources within the same country.[32]

It is apparent that existing classification systems are not suitable for all research and program needs. Nevertheless, some minimal classification is necessary in order to reduce to usable terms the enormous number of distinct occupations which can be identified. Moreover, there are significant advantages in efficiency and communication to be achieved by standardizing classifications. Thus, it seems worthwhile to review the various occupational classification systems which have been proposed in light of the various claims which are made on a national system of occupational data. The next chapter attempts to explicate the occupational data needs of five major uses of occupational data. That is followed in Chapter III by descriptions and evaluations of each of the existing types of occupational data classifications. The remaining chapters outline an alternative, a functional classification of occupations, and its conceptual, operational, and analytical advantages.

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[32] International Labor Office, International Standard Classification of Occupations (Geneva: International Labor Office, 1958), p. 2.

CHAPTER II

NEEDS FOR OCCUPATIONAL DATA

To provide a frame of reference for the appraisal of various occupational classification systems, it is necessary to develop a clearer understanding of the needs for occupational data. It is especially important to treat this matter explicitly, since the literature surrounding most occupational classification systems does not deal adequately with the relevance of the system to the various needs.

A list of uses for occupational data could easily become very lengthy, and no purpose would be served here by constructing such a list. The present interest in this matter is simply to get an idea of the level of detail, the degree of accuracy, and the type of classifying principle most appropriate for the major uses of occupational data, in order that the various classification systems can be evaluated.

Present-day concerns with occupational data mostly have to do with the changing profile of skill requirements, the impact of these changes on employment opportunities for various segments of the population, and the capacity of the labor force as a whole to provide the required skills. The occupational data needs can be described as being of five general types: data required for general policy considerations, occupational data required for vocational guidance, occupational data required for industrial location and wage decisions, and the requirements of special purpose studies and projects. Job placement is often mentioned in this connection also, but it is an activity which requires only an occupational coding system, not a set of occupational data. Since it is not a major data-using activity, it can be excluded from the present discussion, with the observation that the occupational classification system used in job placement should be compatible with the general-purpose system used to classify data, largely because job placement activities represent a potentially significant source of occupational labor market data.

Occupational Data Requirements for General Policy Considerations

In historical perspective, the most significant development of the mid-1960's as far as the labor market is concerned may prove not to have been the reduction of cyclical unemployment after all, but rather a commitment to a positive, national manpower policy. The content of such a policy has been discussed in several

Congressional hearings as well as in books by many leading labor economists of this country. (The recent rash of manpower policy books bear the names of Robert Gordon, Garth Mangum, Richard Lester, Eli Ginzberg, Seymour Wolfbein, Wight Bakke, and others.) For the most part, these discussions have dealt with the government's role in two areas, (1) developing manpower resources through education, training, and promotion of employment opportunities for disadvantaged groups, and (2) improving the functioning of the labor market through improved labor market information, effective labor market intermediaries such as the Employment Service and reduced discriminatory barriers to geographic and occupational mobility.[1] The Gordon Committee, in its 1962 examination of employment and unemployment statistics, articulated the need in the following terms:

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[1] A somewhat different characterization is made by Arnold Weber, who describes two kinds of manpower programs, ". . . those that are client-oriented and those that are institution-building and improving . . . . That is, there are those manpower programs that will have as their objective the alleviation of the economic plight of identifiable groups that, at any particular time, suffer special disabilities in the labor market . . . . On the other hand, there are those programs whose goal will be to build or improve those institutions that are directly concerned with the quality and allocation of the nation's manpower. This means programs to improve the educational system, to develop effective systems of labor market information, to remove barriers to entry, and to stimulate individual and corporate investment in human resources" (Arnold R. Weber, "Discussion," *Toward a Manpower Policy*, ed. by Robert Aaron Gordon (New York: John Wiley & Sons, Inc., 1967), p. 68.

> Current occupational data are needed to evaluate the impact of automation and of other technological changes and shifts in demand on the occupational structure of the labor force. There is increasing emphasis on retraining experienced workers displaced by structural changes. The Manpower Development and Training Act, now in the initial stages of operation, represents a national effort to qualify workers for jobs in expanding occupations or where known shortages exist. Information on trends in the number employed in specific occupations is essential in order to evaluate the success of training programs in adding to skilled manpower resources and in order to carry out the training and reporting provisions of the Manpower Development and Training Act.[2]

Any of these matters must ultimately be dealt with at a detailed, operational level as well as at a general, policy level, but the principal question at this point is the kind of occupational information required for the formulation of policy.

Aside from policy and programs which have full and efficient manpower utilization as their central concern, there is also a growing awareness of the manpower implications of other major federal programs. Unhappy experiences with programs which failed for lack of appropriate manpower have led program planners and the Congress to take cognizance of the manpower requirements of new programs in such diverse areas as health and housing.

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[2] President's Committee to Appraise Employment and Unemployment Statistics, Measuring Employment and Unemployment, p. 202.

The kind of data required for public policy of this sort is broad rather than specific. With respect to the appropriate occupational definitions, such categories as "building trades," "engineering and related manpower," and rather broad occupational groups such as "health services manpower" are most useful, because they represent the manpower counterparts of the relatively broad areas of activity--housing, health, etc.--for which program policy is made, and because they analyze together the occupations at various levels directly affected by particular policy decisions.

For general policy, the most useful kind of information is that which highlights growth relationships among the broad occupational groups in question. For instance, it is important to have some knowledge of what effects an urban highway building program will have on the need for transportation and social service manpower as well as its effect on the demand for an allocation of construction workers. The ability to anticipate secondary labor market supply and demand effects of program policy decisions is probably as important as sophisticated projections of a more conventional, detailed sort. The rush to physical science and engineering research brought on by the race to the moon had significant consequences for health services by reducing the talent flow to medical schools; a useful occupational classification system would facilitate the recognition and analysis of such consequences of policy decisions.

In the case of policy considerations, fairly long-range time periods need to be considered, despite the many problems in projecting occupations beyond the immediate future.

> Beyond ten years, quantitative forecasting of occupational needs confronts serious obstacles. Within a decade there is considerable stability in the occupational pattern of many industries. Innovations that alter production techniques and occupational mixes with industries can be known for as long as five years ahead. Forecasting of such technical advances may be extended a few years by better systems of information and analysis. But beyond, say, ten years the basic uncertainties increase significantly.[3]

Given the role of policy in an open labor market, it seems reasonable to conclude that great accuracy in data is not required for policy discussions any more than great detail is required, so long as the general structure of underlying trends and the implications of various policy decisions can be clearly identified.

The question of the most relevant variable to be used in data classification is hard to answer, because manpower policy covers such a broad field, and because manpower considerations are gradually being dealt with more explicitly in other types of policy decisions.[4] By virtue of the fact that broad groups are being considered, the degree of homogeneity within each group will be relatively low, whatever classifying variable is used. Perhaps only general criteria for the selection of a classifying variable can be suggested here. Since education and training have such a central position in manpower policy today, the classifying variable should be one which allows meaningful conclusions to be drawn about educational implications of policy decisions. In this regard, it would seem that similarity in educational fields would be more appropriate than similarity of formal educational level, since relative substitutability among occupations within the group would seem to be a desirable feature of the system. For example, it would probably be more useful for most manpower policy considerations to have engineers and draftsmen similarly classified than to have engineers classified with physicians and draftsmen with nurses. The classification should also be one which co-classifies occupations with interrelationships which are fixed by technology or other factors, such as the "medical team" or the various occupations along a technologically determined production process.

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[3] Richard A. Lester, Manpower Planning in a Free Society (Princeton, N. J.: Princeton University Press, 1966), pp. 115-116.

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[4] Obviously, occupation by industry classifications are highly useful in revealing the consequences of policy changes, especially in light of the increasing use of industry input-output techniques for such purposes. Thus, it would seem to be desirable to develop the capability to cross-classify whatever occupational system is used with conventional industry categories.

In summary, it appears that great detail and great technical accuracy of data are not as important for manpower policy considerations as the clear exposure of relationships among economic and policy variables. Moreover, it seems that the broad categories of a useful data system should bring together occupations with high substitutability or fixed coefficients.

Occupational Data Requirements for Curriculum Planning

Curriculum planning occurs at two levels. One involves decisions about the amount and type of education to be offered; this level is usually carried out with reference to developing countries and goes by the title of education planning. The second level has to do with the specific content of course and program curricula. The first level is much a part of policy, whose needs were discussed previously. The discussion here will therefore concentrate on the more detailed needs of course and program planning. Curriculum cannot be planned in isolation. To achieve its social objectives, specific curriculum planning must be carried on within the broader context of education planning. Participants in the UNESCO conference on manpower aspects of education planning observed repeatedly that "educational planning can be really effective and consistent with economic development only if it comprehensively embraces all levels and types of education, including non-formal education."[5] (Non-formal education is defined as including on-the-job training, literacy training, agricultural extension, and community-development services.)

Curriculum planning, especially in high schools and community colleges, is presently in greater need of useful occupational data than any of the other major users. This is the case partly because efforts are now being made to up-date vocational course offerings at all levels of instruction, partly because specific occupational education is becoming increasingly important to success in certain occupations, and partly because occupational curricula require frequent review and revision to keep them in tune with labor market developments.[6]

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[5] UNESCO, International Institute for Educational Planning, Manpower Aspects of Educational Planning (Paris: United Nations Educational, Scientific, and Cultural Organization, 1968), p. 18.

Robert Gordon explains the need for information in these terms:

> At the heart of this concern with occupational trends is the fact that changes in the occupational pattern of employment--particularly in the world of today and tomorrow--call for heavy investment and careful planning in education, training, retraining, and vocational counseling.[7]

It is difficult to discuss occupational preparatory education without getting involved in the debate over vocational versus general education. Despite some of the rhetoric, that debate really has to do with the appropriate balance between vocationally oriented and generally oriented curricula, for few partisans of general education go so far as to deny that some form of vocationally specific education is necessary in at least some instances (e.g., nursing, engineering, law, mechanics, and college teaching). On the other hand, few would deny that there is substantial transferability of both skills and attitudes between employment and the individual-citizenship contexts of living, so that much of the curriculum can serve both purposes. To quote the National Commission of Technology, Automation, and Economic Progress,

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[6] Some observers believe, however, that there is already more information than is being utilized. See, for instance, Garth L. Mangum and Arnold L. Nemore, "The Nature and Functions of Manpower Projections," Industrial Relations, V, No. 3 (May, 1966), pp. 1-16.

[7] R.A. Gordon, ed., Long-Term Manpower Projections (Berkeley, California: University of California, Institute of Industrial Relations, 1965), p. 34.

> We wish to emphasize at the outset that we regard goals of education as far transcending economic objectives. These goals go beyond economic progress to the development of individuals as persons and as responsible citizens. A clear division of education into its "economic" and "non-economic" aspects is impossible. For example, broad general education has close relevance to the preparation for vocations, and training that is intended to be technical or vocational may have equal relevance to the development of individuals as persons and as citizens.[8]

With respect to this issue, it is sufficient for present purposes to point out that the terms "liberal" and "general" in the context of education must describe a particular approach to the subject, not the subject matter itself, and that "vocational" must similarly describe an approach to subject matter more than a list of subjects themselves. The meaningful difference between general and vocational education is not the quantity or quality of education nor even the subject matter. The difference is one of objectives, context, and to some extent, methodology.[9] A logical corrolary to this conclusion is that occupational information has applications in education besides its apparent role in occupation-preparatory program planning. Some appreciation of the diversity of human work activity and the functioning of the labor market seem essential subject matter for a truly general, or liberal, curriculum.

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[8] National Commission on Technology, Automation, and Economic Progress, Technology and the American Economy, I (Washington, D. C.: U.S. Government Printing Office, 1966), pp. 43-44.

The present concern with vocational education and curriculum planning is both a reflection of historical developments in the field and a response to the pressing needs of the present. Consequently, it exhibits sometimes competing aims and reveals different needs for information. At one time, the philosophical foundation of vocational education was no broader than the sentiment that the teaching of agriculture and mechanical arts was a worthwhile thing and should be encouraged, an attitude which led to the passage of the Morrill Act in 1862 and the establishment of the land grant colleges. The first decade of this century saw the emergence of vocational guidance, a thread which has been further strengthened in the recent re-evaluation of vocational education. The shortages of teachers, scientists, and technicians which developed in the 1950's shifted the emphasis to filling skill shortages, still a major objective of vocational education. The 1960's, however, have seen a growing concern with the labor market problems of certain groups of job seekers, most notably the youth, residents of depressed areas, Negroes, and the poor. Concern with vocational education has become part of a more general concern with social problems, focusing on both the long- and short-range needs of special groups as much as upon meeting skill shortages. Yet, the historical demand that vocational counseling and vocational education prepare a large portion of the nation's young people for careers and that people be trained to fill immediate shortages continues. Compounding the planning problems of vocational educators has been the popularized notion that existing occupations are being rapidly eliminated by automation and replaced by new, exotic jobs, which will in turn suffer the same fate. This fear has now waned, partly because of changing labor market conditions and partly, perhaps, because of the reassuring conclusions of the National Commission on Technology, Automation and Economic

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[9] For a fuller exposition of this point of view, see Lloyd P. Williams, "The Struggle for Balance--Vocational Education in the Western World," Phi Delta Kappan, XLVI, No. 8 (April, 1965), pp. 355-359.

Progress established by an Act of Congress in 1964.[10] Nevertheless, the fear of teaching obsolete skills continues to induce vocational educators to seek clues to "emerging" occupations and to request rather long-range forecasts, while trying to develop broadly applicable programs at all levels in order to provide their graduates a maximum of flexibility in adapting to change.[11] In the process, the legitimate desire not to foreclose young people's options, i. e., to avoid "channeling" them into occupations at too early an age, has become exaggerated, and the stated information requirements have become distorted.

A broader view of the scope of occupational education and more balanced view of information needs was taken at the UNESCO conference on manpower aspects of education planning,

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[10] See National Commission on Technology, Automation, and Economic Progress, Technology and the American Economy.

[11] Two authors have recently argued that such flexibility, which is achieved at a very high price, may be required precisely because existing forecasts are inadequately used, not because the labor market demands such flexibility. See C. Arnold Anderson, "The Adaptation of Education to a Mobile Society," Journal of Human Resources, II, No. 2 (Spring, 1967), pp. 221-253; and Harold L. Wilensky, "Careers, Counseling, and the Curricula," Journal of Human Resources, II, No. 1 (Winter, 1967), pp. 19-40.

> It was urged that manpower . . . in-service training should be elaborated.[12]

The general issue of the appropriateness of vocational education is essentially a policy consideration, and requires the kind of general information described in the previous section. It is apparent that there are some rather substantial issues in educational planning, however. Included are determinations of specific program areas and types of instruction, as well as the specific skills and work habits to be included in the curriculum.

In discussing the occupational data needed for curriculum planning, it is fruitful to consider first the question of the appropriate level of detail, because much of the disagreement over data needs appears really to be a failure to be explicit about the educational level in question.

In reality, since both education and occupational choice are developmental processes rather than single events, there are probably several levels of informational detail needed; each is appropriate at one stage or another in the process. It appears that there are at least three such levels. The first and most elementary level of vocational education is often described as exploratory, and is most often represented by an instructional unit in the junior high school curriculum dealing with the "world of work." The intent is to introduce youngsters to the variety of kinds of work that exist, and to help them begin the selection process which ultimately will lead to employment in a particular occupation. To a large extent, instruction at this level is geared more to occupational guidance than to employment skill development. Very little informational detail is needed here; most appropriate are broad categories which discriminate among fields of endeavor in a meaningful way, somewhat like the broad groups discussed earlier in terms of general policy. Very few specific vocational skills can be taught at this level, although the fundamental personal qualifications for holding any job can be studied and the relevance of various fields of knowledge can be indicated.

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[12] UNESCO, International Institute for Educational Planning, Manpower Aspects of Educational Planning, p. 21.

The second, intermediate level is the one now receiving the greatest attention in secondary school curriculum planning. Its purpose is to provide students with technical skills which will serve as a foundation for a substantial number of occupations within a "job cluster" or area of work, but it does not attempt to produce fully trained personnel in any one of the occupations. Under a job cluster arrangement, occupations requiring the same sort of

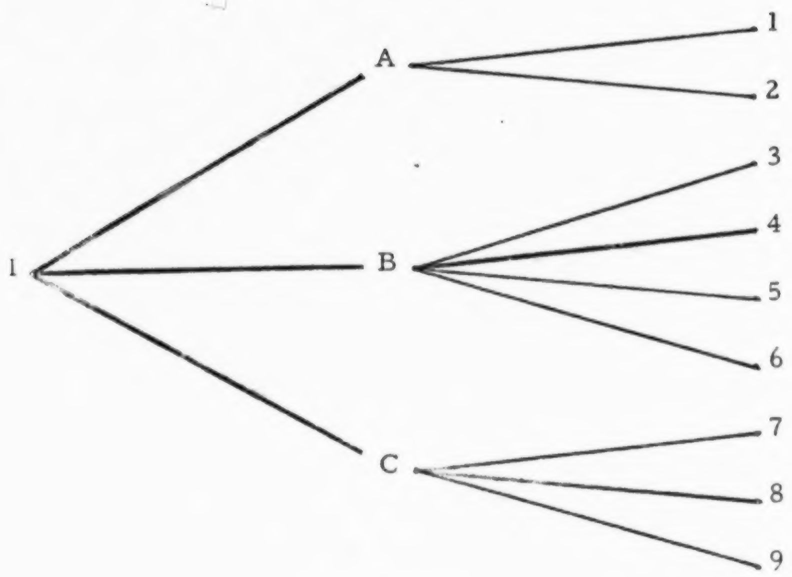
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Fig. 1.--A hypothetical occupational arrangement showing three levels of detail preparation are grouped together, so students can prepare for a "cluster" of related occupations. The concept is that vocational curricula should prepare students for a variety of related occupations to broaden the student's studies and thereby prepare him for future changes in job structures. Clustering also appears to be a practical approach for the school which cannot, and perhaps should not, hope to offer programs for each of several hundred specific occupations. Moreover, this level of preparation may prove to be adequate for many unskilled and semi-skilled occupations. The teaching of technical skills is augmented with attention to certain fundamental qualifications for holding most jobs. These fundamentals are described by one author as the knowledge of how to work and the ability to experience satisfaction in work, the ability to cooperate with other people in a working environment, the ability to read functionally, and the knowledge of simple arithmetic.[13]

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[13] Harold T. Smith and Henry C. Thole, "Secondary and Post-secondary Occupational Education in Kalamazoo County, Michigan," Dimensions of Manpower Policy: Programs and Research, ed. by Sar A. Levitan and Irving H. Siegel (Baltimore, Md.: The Johns Hopkins Press, 1966), pp. 162-163. These authors also make the significant point that vocational education must concern itself with such fundamental matters because every youth no longer learns how to do manual work at home, p. 163.

Whether this innovation is in fact a major development in education is yet to be seen. "Unfortunately information in such programs goes little beyond the anecdotal stage. It is difficult to appraise their significance."[14]

The attention vocational education is now receiving, however, suggests that it will continue and is therefore deserving of consideration in the design of an occupational data classification system.

Instruction at the job cluster level obviously requires more detailed occupational information than does the exploratory level. However, something broader than individual occupations is required. The concept of job clusters has emerged to describe the level and kind of information needed for this purpose. Most discussions of job clusters seem to suggest that approximately twenty to thirty categories which reflect similarity in types of skill (but not skill levels), and relatively high transferability among occupations within the cluster would be most appropriate.

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[14] Gerald G. Somers, "The Response of Vocational Education to Labor Market Changes," Vocational Education. Report of a Conference Sponsored by the Brookings Institution, published as a supplement to the Journal of Human Resources, III (1968), p. 38.

The third and final level of instruction is that which fully prepares its graduates for employment. Graduates may be prepared one or more occupations, but the essential character of their training is their qualification for employment with a minimum of additional on-the-job training. This level of instruction is most frequently found in the occupational programs of community colleges and in universities' professional schools, although high school programs can provide this level program in many occupations. It is readily apparent that extensive information about specific occupations is needed for this curriculum planning, and similarity occupations must be pervasive before they can be grouped together in a single curriculum.

From the above discussion, it can be concluded that instruction at the first two levels is relevant to a number of occupations, and that at first very broad and then intermediate groupings are appropriate. At the final level, specific occupations must be dealt with individually.

The question of the appropriate basis on which data should be classified is a difficult one to answer, in part because the literature is so unclear on the subject. Much of the information needed for curriculum planning has to do with the skill content of occupations and the transferability of trained personnel among occupations.

These characteristics of occupations seem to be the most relevant variables by which occupational data should be classified for curriculum planning purposes. Nevertheless, there is a strong inclination on the part of educators to recommend classification on the narrower concept of "teachable content" of the occupations. A fuller examination of this possibility will be made in a later section dealing with classification systems. It can be concluded at this point, however, that the appropriate classifying principle will be a variable that identifies the essential skill content of the job itself.

Turning to the question of precision in the forecasts of occupational demand, it appears that precision is not of the greatest importance at the first two levels of vocational education, as long as some indication of the relative sizes and growth patterns of occupational areas can be given. The very fluid state of young people's career decisions at these stages and the rather general nature of the instruction they receive suggest that curriculum planning at that level is one of the less demanding needs for occupational information, at least in so far as data precision is concerned. Thus, it is reasonable to conclude that the precision of information available from a general purpose data system would be adequate for these purposes as long as the classification system was appropriate.

At the third level, where complete qualification for employment is the goal, precision in information is much more critical, both as to skill and other hiring requirements, and as to future employment demand. Especially in the case of programs which are preparing people for employment in highly localized labor markets, wherein unusual requirements may prevail, general purpose information may not be sufficient. In such cases, special studies may be required if adequate information is to be made available.

Occupational Data Requirements for Vocational Guidance

Most text books for students of vocational guidance only describe the existing occupational classification systems and suggest how existing information can be used. In discussing the informational requirements for effective counseling, they list the types of information which might be used were it available, but they do not discuss the important question of whether clients should be directed toward general fields of endeavor or toward specific occupations, nor do they indicate which types of information are crucial.[15] Thus it is necessary to look elsewhere for indications of the most useful classification and level of detail in occupational information for vocational guidance. An alternative is to review the theories of occupational choice, with their implicit data requirements. One of the most provocative theories is the developmental theory articulated by Eli Ginzberg, among others, in his thirty-year Conservation of Human Resources project at Columbia University. It is not appropriate to outline the theory here, but it is worthwhile to note that he sees occupational choice as a developmental process: "It is not a single decision, but a series of decisions made over a period of years. Each step in the process has a meaningful relation to those which precede and follow it." In general terms, Ginzberg views the process as containing three periods, in which first fantasy, then tentative, and finally realistic choices are made. With regard to the entire process, he found it to be largely irreversible, and he found compromise to be an essential aspect of each choice.[16]

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[15] See, Carroll L. Shartle, *Occupational Information*, 3rd ed. (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959); Robert

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Hoppock, Occupational Information (New York: McGraw-Hill Book Company, Inc., 1957). Note especially the three page list of Check Lists of Facts about Jobs for Use in Vocational Guidance, pp. 18-20.

[16] Eli Ginzberg, The Development of Human Resources (New York: McGraw-Hill Book Company, 1966), pp. 47-57.

Perhaps the most highly regarded of the career development theorists is Donald Super, whose theory emphasizes the different needs and abilities of individuals and the importance of self-expression through work as well as the developmental character of the career choice process. He says, in part:

> 1. People differ in their abilities, interests, and personalities.
>
> 2. They are qualified, by virtue of these characteristics, each for a number of occupations.
>
> 3. Each of these occupations requires a characteristic pattern of abilities, interests, and personality traits, with tolerances wide enough, however, to allow both some variety of occupations for each individual and some variety of individuals in each occupation.
>
> 4. Vocational preferences and competencies, the situations in which people live and work, and hence their self concepts, change with time and experience (although self concepts are generally fairly stable from late adolescence until late maturity), making choice and adjustment a continuous process.
>
> 5. This process may be summed up in a series of life stages characterized as those of growth, exploration, establishment, maintenance, and decline, and these stages may in turn be subdivided into (a) the fantasy, tentative, and realistic phases of the exploratory stage, and (b) the trial and stable phases of the establishment stage.[17]

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[17] Donald E. Super, "A Theory of Vocational Development," *American Psychologist*, VIII, No. 5 (May, 1953), p. 189.

Developmental theories such as those of Ginzberg and Super seem to require information which is increasingly sophisticated and presumably increasingly detailed as the person passes through the stages of development. While any "stages" theory is subject to oversimplification and hence to criticism, the Ginzberg and Super constructs represent the predominant body of thought among career choice theorists. If one accepts the proposition that occupational choice is a developmental process, it follows that information should be presented at various levels of detail and sophistication, corresponding to the various stages in the process.

It seems likely that great detail in the identification of occupations would only confuse clients in the early stages of career choice. Youngsters' extremely limited knowledge is a fact to be reckoned with. A recent study of ninth grade students in different American communities revealed that the typical student could list only about twenty-two different occupations, and typically identified only five as being occupations for which he was personally suited or which he might follow later on. Further evidence that the typical youngster is not equipped to consider large numbers of highly specific occupations is the fact that the occupations listed were such very common ones as carpenter, teacher, electrician, nurse, pilot, and secretary.[18]

Individuals in later stages of career choice probably need more detailed labor market information, and may therefore find greater occupational specificity to be more relevant; although the literature on vocational guidance leaves the impression that more comprehensive information about fairly broadly defined occupations is of greater urgency than more detailed definitions. It does seem safe to conclude from this literature that various levels of detail are required for various stages in the occupational choice process. Something like the three levels of detail suggested for curriculum planning would seem to be appropriate here as well.

With regard to the question of accuracy, the individualistic nature of the vocational guidance process, together with the fact that occupational demand information is not the prime consideration in the career choice process, seem to suggest that great accuracy in employment demand forecasts is not vitally important. On the contrary, very general indications of the strength of employment opportunities in various occupations is probably sufficient accuracy.

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[18] Leona E. Tyler and Norman D. Sundberg, Factors Affecting Career Choices of Adolescents (Cooperative Research Project No. 2455) (Eugene, Oregon: University of Oregon, 1964). It is interesting to note that youngsters from an upper-class neighborhood, when compared to students from middle and lower class neighborhoods, could identify at least half again as many occupations and considered nearly twice as many to be personally relevant.

With regard to the third question, concerning the appropriate classifying principle, it is hard to draw clear conclusions. Writers in the field of vocational guidance are fond of listing the various kinds of information which are useful in vocational guidance, and some such lists extend to several pages. This concern with comprehensiveness is undoubtedly a function of the diverse considerations which go into a good career choice. On the one hand, it is necessary to develop some comprehension of the large, complex labor market, but some assessment of the individual--his aptitudes, interests, and his ability to fit into various work situations--is also essential.

An outstanding feature of the practice of vocational guidance is the degree to which this client-oriented process focuses upon the characteristics of people filling jobs, rather than upon the jobs themselves. As psychometricians have progressed in their ability to measure individuals' interests and aptitudes, vocational counselors have wished to relate personal traits to occupational success, on the assumption that these measurable variables are critical in determining success or failure in occupations.[19]

Thus it is that one of the standard text books in vocational guidance says that information is needed regarding the following personal occupational requirements: mental abilities, aptitudes and special abilities, character and personality, physical characteristics, sex, age, citizenship, race, creed and national origin.[20] This overriding concern with the personal characteristics of job seekers has led to numerous efforts to classify occupations in such terms as aptitudes and interests. Some of these efforts will be discussed later; it is sufficient at this point to recognize the abiding concern in vocational guidance with such matters and the diversity of personal attributes with which such a concern apparently must deal.

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[19] There is some evidence that each occupation attracts and retains people with similar personalities. If this is substantially the case, predictability of success in an occupation would be enhanced by knowing the personal characteristics of persons already employed in the occupations. See John L. Holland, The Psychology of Vocational Choice (Waltham, Mass.: Blaisdell Publishing Co., 1966).

[20] Max F. Baer and Edward C. Roeber, Occupational Information: The Dynamics of its Nature and Use, 3rd ed. (Chicago: Science Research Associates, Inc., 1964), Chapter 9.

Despite this heavy emphasis on personal traits in career choice, it must be recognized that these personal characteristics cover only part of the information relevant to career choice. There is general acceptance in theory, if not in practice, that the labor market is an important factor in career choice and the individual needs information about it. In fact, one author forthrightly states, "Vocational guidance is implemented through the use of appropriate occupational information."[21] Such statements reveal that, despite the great emphasis on personal characteristics, there is also a recognized need for information about jobs themselves--duties, hiring requirements, and demand.

The work of one team of social scientists, including economists, sociologists, and psychologists, stressed the relevance of both internal and external factors on occupational choice. Their conclusion seems most reasonable, namely that a sound occupational choice depends both on personal factors of the individual--personality and socio-psychological attributes--and upon exogenous factors--geography and resources, historical developments, socio-economic organization and employer hiring requirements, as well as upon intermediate determinants such as information about occupational opportunities and technical qualifications.[22] Ginzberg seems to draw a similar conclusion, indicating that a sound vocational choice requires information about both the individual and the labor market in which he is to function.[23]

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[21] Herman J. Peters and James C. Hansen, ed., Vocational Guidance and Career Development (New York: MacMillan Co., 1966), p. 173.

Thus, this discussion must conclude with the observation that the occupational information most relevant to vocational guidance is information at varying levels of detail corresponding to the various stages in the career choice process. It is also evident that precision is not a major requisite of data for this purpose. As to the most appropriate classifying variable, it will be one which reflects both characteristics of the job and characteristics of workers.

Occupational Data Requirements for Industrial Location and Wage Decisions

There is a growing opinion, at least in popular economic writings, that ". . . industry is moving where the manpower action is,"[24] despite the low ranking traditionally accorded labor as a determinant in industrial location. The opening sentences of a recent study of economic growth in the Northwest illustrates this new emphasis on labor considerations.

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[22] Peter M. Blau, John W. Gustad, Richard Jessor, Herbert S. Parnes, and Richard C. Wilcock, "Occupational Choice: A Conceptual Framework," Industrial and Labor Relations Review, IX, No. 4 (July, 1956), pp. 531-534.

[23] Ginzberg, The Development of Human Resources, pp. 47-57.

> A fundamental factor in the evolving economic structure is the increasing importance of the human element. More and more businesses are demanding highly skilled and stable work forces, and industry is locating where the best quality labor is available or can be attracted.[25]

This interest in the supply of trained and trainable manpower in industrial location decisions, whether it has become a "fundamental factor" or not, represents an important use for occupational supply and demand information.

Other types of rational production planning also require information about the availability and price of various types of labor. Along with information about the supply and prices of other production factors, "For given conditions of product demand, production plans will be made by cost-minimizing decision-makers on the basis of information concerning the availability of various skills or occupational groups--information which is given by an occupational data system--and on the basis of schedules of prices at which these skills are offered . . . ."[26]

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[24] Seymour Wolfbein, "Character and Trends of Employment," Report on the First Annual Conference of the School of Community Service and Public Affairs (Eugene, Oregon: University of Oregon, 1967), p. 17.

[25] Battelle Memorial Institute, The Pacific Northwest, A Study of Economic Growth in a Quality Environment (Columbus, Ohio: Battelle Memorial Institute Columbus Laboratories, 1967), p. 9.

A related interest in occupational data, common to established firms and firms seeking plant locations, is its use as a basis for wage determinations. Locally prevailing wage rates for a variety of occupations are data which are greatly desired by both public and private sector employers.

In contrast to some of the uses previously discussed, the data required for these purposes are rather easily defined. First, highly specific occupational information is ultimately needed, since slight dissimilarities in job duties or employment conditions either in a particular firm or in an area, can have important consequences for in-plant training time and for wage scales. Thus it is important to define occupations in a way that they exhibit a high degree of homogeneity. With regard to the most relevant principle for classifying data, it appears that job duties or some closely related characteristic of the job is most appropriate, in order that substitutability without retraining can be maximized within occupational categories. Here industry and other organizational patterns are often significant variables in classifying the desired information. Finally, with regard to the precision required, it appears that rather exact data are needed and that the consequences of error could be fairly serious. A misestimate of the available supply of labor in a particular occupation could lead to serious production problems, while errors in estimates of prevailing wages could lead to inter-occupational or inter-firm distortions in wage scales.

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[26] Glen Cain, W. Lee Hansen, and Burton Weisbrod, "Occupational Classification: An Economic Approach," Monthly Labor Review, XC, No. 2 (February, 1967), p. 49.

Thus, with regard to the occupational data required for industrial location and wage decisions, it appears that detail and precision are highly important, and that the most relevant bases for categorizing the data have to do with job duties and the organizational structure within which the work is performed.

Occupational Data Requirements for Special Purpose Studies and Projects

The recent attention to manpower problems has generated substantial new research and a host of demonstration projects in addition to the traditional research interests of the various social sciences which have already been discussed. Generalizations about the data needs of these diverse, sophisticated users of occupational information are extremely hard to make, yet this important need cannot be overlooked. Therefore it is worthwhile to attempt to state some of the common requirements of these various needs.

First, with regard to the basis upon which data should be classified, it seems that very little consensus can be found. It has already been observed that few researchers are satisfied with the present socio-economic classification system used by data producing agencies, yet the suggested alternatives, when they are offered, are as diverse as the various research interests. (A more detailed analysis of the various classification systems will be made in the following chapter.) Especially when broad categories are desired, there is a marked lack of agreement on what those categories ought to be. At the other extreme, however, researchers ought to be able to, and in fact implicitly do, agree on the detailed occupational categories. Whether the desired content of the detailed categories has to do with characteristics of workers, or of job duties, or of employment trends, there seems to be no insurmountable disagreement about the occupational definitions of the detailed categories. Most would seem to be able to agree on a detailed listing in which the occupational categories would be reasonably precise but large enough to contain sufficient cases for meaningful analysis. This is an encouraging situation, for, once such categories were defined, each could be coded for a variety of characteristics. Provided the number of detailed occupations were not excessive, grouping of the detailed categories would be a task which could then be performed in a way consistent with the specific needs of each research project, since research personnel would typically possess the required competence in such matters, and the grouping process would not be excessively time consuming.

In view of the fact that agreement among research interests on a general classification principle is unlikely, there is little purpose to be served in discussing at length the broader levels of detail which would be most useful, beyond the detailed level already discussed. However, it appears that both very broad categories and intermediate categories would have their uses in research as in the other needs already discussed.

Research and other special purpose projects, by virtue of their analytical objectives, are generally supposed to require great precision; however, such is not always the case. Useful conclusions are drawn from existing social statistics, many of which are highly imperfect, and it is unlikely that occupational data requirements would be any more stringent. Most research projects would, therefore, probably find general purpose data to be satisfactory for their purposes, and very few would require the precise, localized data required for, say, wage determinations or specific vocational training. Of perhaps greater importance for analytical work is the ability to relate occupational data to other topics; consequently, consistency in time series and compatibility with other social statistics are matters of great importance for research.

In summary, it appears that general agreement could be reached on a detailed listing of occupations for which general purpose data would be useful in special purpose studies and projects. Such data would have substantial utility for these purposes if time-series consistency and compatibility with other social statistics could be established and maintained. For many research purposes it appears that great precision may be less important than this consistency and compatibility. There is probably little likelihood of identifying a classification system whose analytical categories would meet the diverse needs of special purpose studies and projects, but this is not an insurmountable problem as long as the number of detailed occupations remain small enough to make special purpose classification feasible.

Summary of Data Requirements

It may be helpful at this point to summarize the preceding discussion of occupational data requirements. In each section an attempt was made to discover something about the level of detail, the degree of accuracy, and the classifying variable most appropriate for five general uses of occupational information. At this point we can draw some conclusions onthe matters of accuracy and detail. The literature regarding existing and proposed occupational classification systems to be reviewed in the next chapter, has little to add to the discussion of these two issues, though it will sharpen considerably the discussion of the third topic, the most appropriate classifying variable.

Turning first to the question of accuracy, it appears that extreme accuracy is not essential for most purposes. Of all the uses discussed, only specific vocational training and specific industrial location and wage studies were found to require great accuracy; while general policy consideration, vocational guidance, much occupational curriculum planning, and even most special purpose studies and projects could be carried on with moderately accurate data. Richard Lester's comments are pertinent at this point,

> Manpower projections must be judged by their suitability for the purposes they serve. For career choice and vocational guidance, long-run trends and relative magnitudes of change may be satisfactory. Exactness in quantitative terms is unnecessary. For planning of vocational training programs, more detailed data on numbers and on kinds of instruction are desirable. One has to bear in mind that manpower forecasting can serve many useful purposes even when it is only roughly right rather than perfectly correct. With large movements of qualified workers into and out of the labor force during each year, with a large flow of generally well-educated youth into gainful employment each year, and with the adaptability of much American manpower, forecasts that come anywhere within range may be almost as valuable as those that land right on the bull's-eye.[27]

Just as extreme precision appears not to be an overriding consideration, there is little reason to think that extremely detailed data are required for most purposes. Of the several uses discussed, only industrial location and wage decisions and some very specific vocational training appeared to require finely detailed data. It is noteworthy that these are the same uses which require precise data, and they are also the uses which most require geographically specific data. Thus it may be that a feasible, general purpose data system must be supplemented by specific, local studies as specific needs arise. Even in these areas, however,

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[27] Lester, Manpower Planning in a Free Society, pp. 116-117.

It appears that, at most the appropriate number of specific occupational categories is in the hundreds rather than in the tens of thousands.

As for the other uses of occupational data, the need for detailed data are much less critical. Many needs apparently could be met by a few very broad categories, and most could be satisfied with an intermediate level of detail. These include early vocational counseling, much curriculum planning, nearly all manpower policy considerations, and even many manpower studies. While greater detail and precision are frequently, though not always, desirable, they are not achieved without cost.

> In developing and implementing a system, it should be borne in mind that more detailed standardization, added flexibility, and added precision in measurement, all come at increased cost. Thus, users of the data system--researchers as well as labor and employer groups--have a serious obligation to justify in terms of real benefits to be produced, the demands they make on governmental agencies responsible for developing an occupational classification system.[28]

From the above discussions, it seems reasonable to conclude the three-level system discussed in regard to vocational curriculum planning would meet nearly all needs. Such a system would consist of, at most, several hundred occupational categories which would be specific enough to show considerable homogeneity of job duties but broad enough to include substantial employment. At the next higher level would be an intermediate level of detail consisting of some twenty to thirty categories, which would be useable for a variety of purposes. Finally; the classification system would be summarized into a few, say five to ten, broad groups, a level which would facilitate broad understanding of occupational characteristics and trends.

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[28] Glen Cain, W. Lee Hansen, and Burton A. Weisbrod, "Occupational Classification: An Economic Approach," p. 52.

The most difficult question remains, namely, what principle is to be used in constructing the various categories. It has already been noted that there is general dissatisfaction with the commonly used socio-economic system. Yet no consistent pattern of need seems to have emerged which would suggest a generally applicable alternative, except at the most detailed level. Here, there seems to be a consensus that the categories are best defined in the conventional way, in terms of work performed; but there is a growing list of information which is desired about each of these occupations.

At the broader, analytical levels, characteristics of the job still seem to be relevant for industrial location and wage studies, for much policy making, curriculum planning, and many special purpose studies, and, to some extent, for vocational guidance. However, there is no agreement as to which characteristic of the job is most relevant, and there is considerable need for information classified in terms of the characteristics of persons filling positions, especially in vocational guidance. It seems appropriate, therefore, to leave this question of the classifying principle open for consideration during the following discussion of the existing and proposed classification systems.

CHAPTER III

TYPES OF OCCUPATIONAL CLASSIFICATION SYSTEMS

With the preceding discussion of data needs, it is now possible to review and, to some extent, to evaluate existing data classification systems in terms of their usefulness for the various purposes to which occupational data are put. It already has been pointed out that the literature regarding occupational data classification systems says remarkably little about the needs which the systems are intended to meet. Consequently, any evaluation of the systems must first attempt to identify the principal uses of the systems, as was done in the preceding chapter, and then to consider how well the systems meet those needs. The purpose of this chapter, therefore, is to review the various occupational data classification systems which have been developed and to attempt to discover which is of greatest general applicability to the needs previously identified. The primary emphasis here will be on identifying the most appropriate classification principle. That, together with the conclusions about detail and accuracy drawn in the previous chapter, will facilitate the appropriate classification of the empirical data of this study.

Existing occupational data classification systems are of three general types. The only systems which are widely used in presenting occupational data at the present time are the socio-economic type, of which the Census and Dictionary of Occupational Titles systems are the best known and most widely used. Out of the criticism of these systems have developed two types of alternatives--those which emphasize worker traits and those which concentrate on curriculum areas. The merits and weaknesses of each of these three types will be discussed, and a fourth will be presented which, hopefully, will serve a major portion of the needs defined in the previous section.

Socio-Economic Occupational Classification Systems

Socio-economic classification systems attempt to describe the socio-economic status ascribed by society to particular occupations and to rank those occupations in accordance with their levels of status. (This ranking is a crucial feature of socio-economic systems and a feature which raises serious problems, as will be seen later.) Socio-economic classification systems are descriptive of the job rather than the individuals who fill the jobs. Their wide use--socio-economic systems are the only type in general use by data producing encies--is probably more appropriately attributed to their lengthy tory than to any superior analytical usefulness or to their ease applicability.

There are two occupational classification systems in general e in the United States, the Census system, which is used in the ecennial censuses of population and the Monthly Report on the Labor Force, and the Dictionary of Occupational Titles (D. O. T.), which is used by the federal-state Employment Service system. Both are essentially socio-economic in structure, although the third edition f the D. O. T., dated 1965, uses somewhat more of a functional rouping for production occupations. A third widely used system of e same general type is the International Standard Classification of Occupations (I. S. C. O.) developed by the International Labor Office. As the following table reveals, the three systems show substantial imilarity in their identification and ranking of broad occupational groups. Such groupings attempt to reflect two features of ccupations: the nature of jobs ("job families"), and the ranking f occupations ("level").

The implicit assumptions required to achieve such a system are worth noting. Theodore Caplow identifies five: (1) white collar ork is superior to manual work, (2) self-employment is superior to employment by others, (3) clean occupations are superior to dirty

TABLE [illegible]

BROAD OCCUPATIONAL GROUPS IN THREE MAJOR SOCIO-ECONOMIC CLASSIFICATION SYSTEMS

Census (1960)	DOT Second Edition (1946)	DOT Third Edition (1965)	ISCO (1958)
Professional and Technical	Professional and Semi-Professional	Professional-Technical	Professional-Technical
Managers, Officials, and Proprietors Except Farm	Managerial	Managerial	Executive, Administrative, and Managerial
Clerical	Clerical	Clerical	Clerical
Sales	Sales	Sales	Sales
Private Household Workers Service Workers Except Private Household	Service	Service	--
Farmers and Farm Managers Farm Laborers and Foremen	Agriculture, Fishery, and Forestry	Farming, Fishing, Forestry	Farm, Fishing, Logging
Craftsmen and Foremen	Skilled	Processing Machine Trades	Craftsmen, Production
Operatives	Semi-skilled	Bench Work	Transport and Commerce
Laborers Except Farm and Mine	Unskilled	Structural Work	Process Workers and Laborers
		Miscellaneous	
Occupations Not Reported	--	--	Unclassified and Armed Forces

ones, (4) the importance of business occupations depends on the size of the business, except in agriculture, and (5) personal service is degrading and it is better to be employed by a firm than in the same work by a person.[1]

There has recently been a rash of criticism of existing occupational data from various users of the data. For the present purposes, it is important to distinguish between the criticism which has essentially to do with the classification system itself and that which has to do with the collection and tabulation of data. Obviously, the two are interrelated, and the classification system is at least partially to blame for such data problems as the one-third of the employment reported in the 1960 Census appearing in residual, "not elsewhere classified," categories. Since the present purpose is to review the various classification systems, however, it would be inappropriate to discuss the quality of the data in detail here; that will be undertaken in a later chapter. Instead, the present discussion will concentrate on the conceptual problems inherent in the classification systems themselves.

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[1] Theodore Caplow, The Sociology of Work (New York: McGraw-Hill Book Company, 1954), pp. 42-43.

One of the most frequent and fundamental criticisms of the existing socio-economic systems is that they combine several variables in defining occupational groups, resulting in a hybridized system which yields data that are not entirely satisfactory for any purpose. The discussion of this problem can proceed at two levels. First, there are the problems in constructing analytically useful summary categories. Secondly, there is the problem of establishing consistent definitional categories. The preceding table shows that, even at the broadest level, the Census and *DOT* systems often reflect variables other than socio-economic status in classifying occupations. The existence of an agriculture-forestry-fishing category, which includes everyone from farm managers to farm laborers, reveals the use of an industry criterion, for instance. Similarly, even a brief examination of the detailed Census and *DOT* occupational classifications reveals that a multi-dimensional system is being employed even at the more detailed analytical and definitional levels, despite the frequent statement that jobs are classified on the basis of task performed.[2] Robert W. Hodge and ul M. Siegel of the National Opinion Research Center, offer a mber of examples of inconsistency from the Census in their article in the 1966 Proceedings of the Social Statistics Section of American Statistical Association, some of which are used in following discussion.[3] While many occupations are defined by ir job duties "Professional Nurses," "Student Nurses," and pprentices in the trades are defined in terms of both job duties d certification requirements, although this latter characteristic occupations has not been employed extensively in defining other cupations. Relations to fellow workers appear in the case of emen, leadmen, and helpers, while the institutional setting parently is the basis for distinguishing "physician's and dentist's ice attendants" from "receptionists" and "secretaries." dustry is a frequent source of distinction, as in the case of railway conductors" and "bus and street railway conductors" and the frequent separation of service workers in private households om those in commercial establishments. Academic field is used preference to function in some cases, but not in all. For example, high school music teachers are classified as "occupations in music" in the DOT, but speech teachers are classified with "occupations in secondary school education." Moreover, the attempt to arrange occupational groups in a continuum on the basis of status involves another whole type of classification, a classification based on "level" rather than "job family." In these socio-economic systems, occupations are not defined solely in terms of the tasks performed, but also, often without consistency, in terms of other variables. The relative positions of some occupations and occupational groups within these classification systems is also questionable. Service workers, for instance, rank above skilled trades in the DOT and manufacturers' representatives (a sales occupation) and certain skilled craftsmen rank below, for example, file clerks (a clerical occupation). The incongruities just noted undoubtedly come about because multiple classifying principles have been used.

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[2] See, for instance, Leon Lewis, "Development of the Convertibility List Between the D.O.T. and Census Classification Systems," *1966 Proceedings of the Social Statistics Section of the American Statistical Association*, p. 204.

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[3] Robert W. Hodge and Paul M. Siegel. "The Classification of cupations: Some Problems of Sociological Interpretation," 1966 oceedings of the Social Statistics Section of the American tistical Association, pp. 177-178.

Further problems with the present systems are enumerated by the National Manpower Council.

> It has already been indicated that the broader occupational categories into which different kinds of work are classified depend upon the criteria used. Those generally employed are: the actual operations involved in performing work tasks; the nature of the training required for proficient performance; the earnings derived from the

work; and the social prestige attached to it. The completion of a program of formal higher education and training and the existence of a professional society are used as standards to determine whether a given field is a professional occupation. The size of an occupational group can be substantially affected by the criterion used. If graduation from an engineering school is used to determine the number of engineers, the result is almost 20 per cent--roughly 100,000--below that reported by the Census, which bases its count on other considerations.

Classifications of kinds of work in terms of level of skill also depend upon which criteria are used. The basic rule employed is simple: the greater the preparation and training required, the more skilled the occupation. Its application to specific cases, however, raises countless problems. The skills required for the varied functions of an advanced society form a continuum, and the unskilled, semi-skilled, and skilled categories of occupations and workers represent artificial divisions. The boundary lines separating one grouping from another are of necessity arbitrary. There is, consequently, always ground for legitimate dispute over placing some workers under one heading rather than another.

History and convention may dictate the skill description of an occupation. Many workers in mining continue to be regarded to be unskilled or semi-skilled because of the nature of the work they did years ago, which frequently has little resemblance to what they do today. The machinist's occupation is traditionally viewed as skilled. A study by the U. S. Bureau of Labor Statistics indicates, however, that on the basis of the functions they actually perform, perhaps the majority of those who call themselves machinists in reporting to the Census could be described as semi-skilled. Modern farming requires a high degree of technical knowledge, managerial ability, and competence in the maintenance and repair of machinery and equipment, in addition to more traditional agricultural skills. Yet it is not classified as a skilled occupation.

The problems involved in deciding whether a group of workers belong to one occupational or skill category rather than another have high practical significance. An adequate understanding of the manifold facets of the skill and occupational structure of the nation's work force is essential if sound public policies are to be developed.

The name of an occupation may contribute to its prestige and thus may influence its appeal as a field of work to young people thinking about their future vocations. When, as in the United States, white collar occupations are frequently more highly valued than "blue collar" work, some may be attracted to a field primarily because those in it are called "technicians," rather than skilled workers. The name given to an occupation may affect judgments on the adequacy of the training facilities available. For example, technicians are sometimes defined as workers whose training takes the form of one, two, or more years of post-high school study in technical institutes or in junior or four year colleges. Using this definition, it could be argued that the facilities existing in the United States for training technicians are inadequate.

Occupational and skill classification systems have a bearing on wage rate determination, and they have posed difficult problems for the National Labor Relations Board. In ruling on issues of union representation and bargaining units, the Board has had to decide whether certain groups of workers whose training is of professional nature should be given professional status in view of the actual work functions they perform; or, whether certain technicians should be separated from or classed with "production" or clerical workers. Many arbitration cases under collective bargaining contracts involve questions of skill classification. Finally, the problem of occupational grouping is also involved in many union jurisdictional disputes.[4]

These examples illustrate one set of problems encountered in the socio-economic systems, namely that the use of multiple classification criteria results in both an uneven treatment of the variables being employed and in excessive detail.

In a technical sense, of course, it is not entirely necessary to agree upon a single classifying principle, because we now have the capability of making use of multi-variable coding. ". . . in this day of the computer it is not impractical to think of a variety of systems, each tailored to a specific set of problems, and our thinking is exactly along these lines."[5]

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[4] National Manpower Council, *A Policy for Skilled Manpower* (New York: Columbia University Press, 1954), pp. 45-47.

A similar observation was made in our earlier discussion of the occupational data requirements for special purpose studies and projects, when it was suggested that the basic detailed occupational units could be coded to several variables and classified by the researcher in the way most appropriate for his analysis. Nor is multi-variable coding a new concept. It has long been conventional to cross-classify occupational data by family and by level. (The problem, as we have seen, has been in finding a conceptually and statistically useful definition for such terms as "family" and "level.") The value of a general purpose system has already been argued. Although it has posed serious problems in these occupational classification systems, the problem of arriving at a single, appropriate classifying variable is not insoluble, as the Standard Industrial Classification (S. I. C.) system attests. The S. I. C. is a model system in this regard, in that it classifies establishments ly on the basis of their major products or services as measured value added or some definable proxy for value added.[6] The ection of this single variable does not deny that it is often teresting to know about such matters as the business structure of firm, whether its markets are local or export, its size, or ther its operations are local or national in scope. Nevertheless, technical committee which developed the S. I. C. did not yield the temptation to combine several variables in its classification, d, as a result, avoided many of the problems which are present existing occupational classification systems.

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[5] Stanley Greene, "Some Recent Decennial Census Occupational Experimental Work," *1966 Proceedings of the Social Statistics Section of the American Statistical Association*, p. 196.

Aside from the somewhat uneven treatment of the classifying riables which results from the use of multiple variables, there a problem with the use of resulting data in empirical research. dge and Siegel state the problem succinctly,

> Precisely how the industrial and occupational division of labor are intertwined and the manner in which they are intertwined in different sectors of the economy should be an empirical question. But one can hardly conduct any definitive empirical study of their interrelationships if the answer to the question has already been partially built into the data by the use of industrial and class of worker

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[6] Bureau of the Budget, Standard Industrial Classification Manual (Washington, D.C.: U.S. Government Printing Office, 57). p. 4.

distinctions to define occupational groups. Much the same can, of course, be said, for the use of any criterion other than task similarity to define occupational groups.[7]

It is the position of this paper that both the extreme detail of the D.O.T. and the unevenness of treatment in both the Census and D.O.T. systems would be unnecessary if a single classifying principle were to be used at the detailed, definitional level.

The present situation prompted one commentator to conclude that, "Ultimately, . . . there is little point in evaluating the relative merits of the two broad occupational groups under discussion [Census and D.O.T.]. What is needed is discussion of revision of the entire occupational code, *at the detailed level*, so as to effect occupational categories more homogeneous with respect to the actual tasks performed in the specific jobs assigned to each occupational code."[8]

Even if the single variable of job duties were used at the definitional level, as was suggested earlier, the existing analytical groupings would still be unsatisfactory in that they are also based upon multiple classifying variables. But suppose an analytical system were to be based only on level of status. How well would such a system meet the various needs for occupational data discussed in the previous section?

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[7] Hodge and Siegel, "The Classification of Occupations," p. 178.

[8] *Ibid.*, p. 190.

The rationale for such a system is that there is evidence that persons in occupations exhibit other behavioral similarities besides those required by their occupation, and that the American population generally seems to perceive some rank ordering of occupations. Thus a sociology of occupations has grown up, which is "concerned with occupations as a predictor of behavior and the relation of occupational structures to social structures."[9]

Unfortunately, occupational status is not easily measured because status itself is multi-dimensional. A number of factors help determine occupational prestige; Theodore Caplow, in his *Sociology of Work*, lists the following: responsibility, nature of the work, formal education required, training required, authority, class attributes, and income.[10]

One result is that even the major occupational classification system based solely on status, the so-called "Hollingshead scale," incorporates multiple status measures. In attempting to establish an index of social position for their study of social class differences in mental illness, Hollingshead and Redlich settled upon three characteristics as being most indicative--residence, occupation, and education. In regard to their occupational scale, they report,

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[9] Edward Gross, "The Worker and Society," Henry Borow, ed., *Man in a World at Work* (Boston: Houghton Mifflin Company, 1964), p. 89.

[10] Caplow, *The Sociology of Work*, pp. 52-53.

> The occupational scale is a modification of the Alba Edwards system of classifying occupations into socio-economic groups used by the United States Bureau of the Census. The essential difference between the Edwards system and the one used is that Edwards does not differentiate among kinds of professionals or the sizes and economic strengths of businesses. The scale used in the Index of Social Position ranks professions into different groups and businesses by their size and value. Without further discussion of similarities and differences between the Edwards system and ours, we will proceed to characterize each of the seven positions on the scale we used:
>
> 1. Executives and proprietors of large concerns, and major professionals.
> 2. Managers and proprietors of medium-sized businesses and lesser professionals.
> 3. Administrative personnel of large concerns, owners of small independent businesses, and semi-professionals.
> 4. Owners of little businesses, clerical and sales workers, and technicians.
> 5. Skilled workers.
> 6. Semi-skilled workers.
> 7. Unskilled workers.
>
> The scale is premised upon the assumption that occupations have different values attached to them by the members of our society. The hierarchy ranges from the low evaluation of unskilled physical labor toward the more prestigious use of skill through the creative talents, ideas, and the management

> of men. The ranking of occupational functions implies that some men exercise control over the occupational pursuits of other men. Normally, a person who possesses highly trained skills has control over several other people. This is exemplified in a highly developed form by an executive in a large business enterprise who may be responsible for decisions affecting thousands of employees.[11]

It will be noted, in addition, that this system differs from the broad groupings of the DOT and the I. S. C. O. systems discussed earlier in that it contains no categories which are principally industrial in character. While the broad categories of the Hollingshead scale represent more of a continuum than the standard socio-economic systems, this system runs into problems in the classification of occupations within these broad groups, in that the three variables used do not correlate perfectly for all occupations. Thus , even a classification system which attempts to treat only status, can become subject to the same problems as the more heterogeneous "socio-economic" systems.

An attempt to derive more homogeneous status ranking is to be found in the work of Jerome B. Gordon. By the use of the Census Bureau's Socio-Economic Status (SES) scores, which are emselves based on multiple components, he has grouped census ailed occupations into status groups on the basis of SES score el. One thing that his work reveals is that a strictly status nking of detailed occupations juxtaposes occupations which have ry little else in common. For instance, high status occupations, with an SES of 96 to 100, include, among others, airplane pilots, nkers, physicians, and social scientists. Similar results appear n his other groups.[12]

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[11] August B. Hollingshead and Fredrick C. Redlich, Social Class and Mental Illness (New York: John Wiley & Sons, 1958), pp. 390-391.

The problems created by the use of multiple measures of tatus has prompted two developments in occupational status easures. One is the attempt to identify a single indicator of tatus; the other is the use of opinion surveys to measure public ttitudes toward occupational status directly, rather than through ndirect measures.

Attempts to identify the single crucial variable in the status f occupation seem to have led to the conclusion that "control" is he most crucial variable. Theodore Caplow summarizes the rgument,

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[12] See Jerome B. Gordon, "Occupational Classification: Current Issues and an Interim Solution" (processed) (New York: Columbia University Bureau of Applied Social Research, n. d.).

> Indeed there does seem to be one property of an occupational position which correlates almost perfectly with the rank order of prestige rankings. I have called this element "behavioral control." . . . What this element represents is the status of the individual in the typical situations elicited by his occupational role, vis-a-vis clients, customers, subordinates, superiors, pupils, passengers, or indeed whatever other persons he normally meets in the course of his occupational duties.
>
> There are in all occupations, without obvious exceptions, an element of behavior control . . . .
>
> It would be absurd to suggest that no other element enters into the determination of occupational prestige. Nevertheless it is worthy of note that the position of the subject with respect to the control of other people's behavior and their control of his, appears to conform rather well to what is reported as occupational prestige.[13]

Unfortunately, no classification schemes have been developed based solely on the variable, "behavioral control"; consequently, it is not possible to evaluate the general usefulness of such a system. However, such a measure of level alone would appear not to reflect adequately differences in the substance of the work performed, that is, it would presumably see greater similarity of level between doctors and architects than between doctors and nurses, or architects and engineers. Nevertheless, the fact that the concept of "status" apparently can be reduced to the more conventional organizational concept of control is worth noting.

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[13] Caplow, The Sociology of Work, p. 55.

The other major development in the measurement of status the use of opinion surveys. This development has been made possible largely by the population interviewing conducted by the National Opinion Research Center. One advantage of these surveys is that they measure status directly rather than by relying on the classifier's interpretation of one or more indicators of status. However, they present the same problems for classification as Gordon's SES ranking, i.e., they juxtapose occupations which are very dissimilar in terms of job content. Thus, used alone they fail to meet the test of general applicability. One fact which emerged from the analysis of the opinion survey data is that the entire population does not make consistent discriminations among like occupations. A substantial minority generally rates one of the similar occupations higher than does the majority. Another major finding is that some occupations with sizeable differences in aggregate prestige scores do not scale consistently, because they are rated considerably higher by various population subgroups.[14] This latter fact, the so-called "point of reference phenomenon," discovered in working with the Strong Vocational Interest Blanks. reflects the fact that "differences among specific occupations are perceived significantly only when the subjects classifying them are from similar occupations. From the standpoint of the unskilled worker, all professional men look alike. From a point closer to their own position, differences between them can be observed."[15] Implicit in many classification systems and explicit in some is the proposition that important differences among occupations are found only in the top few percent of the jobs. This view probably reflects the "point of reference" of the systematizer, and should be guarded against in constructing classification systems. This phenomenon may be reflected in the Hollingshead scale, which provides rather refined categories at the top of the scale, but very broad ones at the bottom. It may well be that construction workers would not perceive the distinction between Hollingshead's first two broad categories (e.g., major professionals as opposed to lesser professionals), but would be very much aware of the superior status of a shovel operator as compared to a caterpillar tractor operator. In this regard, it is worth noting that in Hollingshead's final "Index of ial Position," 68.6 percent of the families in the study fall in bottom two of five categories.[16] If all occupations do not fit a single status continuum, then the development of a single tus classification system is precluded. Further analysis of s finding led Paul Hatt to identify several "situses," within ich occupations do scale, but between which scalability is not nd. Hatt identified eight situses, within which some reproduciity is possible, and 27 families within the situses when reproibility is high.

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[14] Albert J. Reiss Jr., Occupations and Social Status (New York: The Free Press of Glencoe, Inc., 1961), p. 95.

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[15] Leona E. Tyler, The Psychology of Human Differences, 3rd ed. (New York: Appleton-Century-Crofts, 1965), p. 201.

Available research leads to the conclusion that a consistent ntinuum of the status ranking of occupations cannot be achieved. best, as Hatt's work indicates, only segments of the occupational ectrum can be so ranked. While knowledge of these "situses" y be useful in determining the analytical groupings of a ssification system, there appears to be little likelihood that a sistent system could be built upon the socio-economic status vel of the occupations.

Furthermore, there is serious doubt whether any socionomic system is adequate for analysis of the manpower issues of itus and Family[17]

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[16] August B. Hollingshead and Fredrick C. Redlich, Social ss and Mental Illness, p. 395.

tical

ational
Local

rofessional

Free Professions
Pure Sciences
Applied Sciences
Community Professionals

siness

Big Business
Small Business
Labor Organization
White Collar Employees

creation and Aesthetics

High Arts
Journalism and Radio
Recreation

Situs and Family

5. Agriculture

Farming
Employed on Farms

6. Manual Work

Skilled Mechanics
Construction Trades
Outdoor Work
Factory Work
Unskilled Labor

7. Military

Army
Navy
Marine Corps
Coast Guard

8. Service

"Official Community"
"Unofficial Community"
Personal

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[17] Paul K. Hatt, "Occupation and Social Stratification," rican Journal of Sociology, LV, No. 6 (May, 1950), p. 540.

ay. This is an issue which was first raised in the preceding pter, and it deserves some additional investigation both because umber of commentators have raised it and because socio-nomic classification systems are the current standard. An derstanding of the purposes for which the historic socio-economic lassification systems were developed is helpful in evaluating their urrent utility. James Scoville has traced the intellectual history f the development of occupational classification systems, and one an do no better than to quote his summary.

> The State of the Data
>
> For our purposes, the first shortcoming of the Census data lies in the theoretical basis of their summary classifications. It must be emphasized that these are neither "jobs" nor "occupations"; they are "social-economic groups." The distinction is crucial. The concept and measurement of social-economic groups stem from nineteenth-century attempts to assess the changing class and skill balance of society. Karl Marx had predicted that the capitalist process would be accompanied by the substitution of capital for labor, unskilled labor for skilled, and women and children for men. Henry George viewed the process of industrialization as, among other things, depriving the worker of the advantages of skill and of opportunities to acquire it. Even an economist of the mainstream, Francis Walker, depicted the worker on a tightrope, constantly threatened by industrial degradation.
>
> In this intellectual milieu, the Census social-economic groups were developed. Analyzing the operation of labor markets, Cairnes had discussed the types of social strata or "non-competing groups" which he discerned there. In 1897, W. C. Hunt made the first attempt to quantify such strata. Hunt reshuffled the contemporary industrial classification into four groups: the proprietor class, clerical worker,

skilled workers, and the laboring class. On this basis he discovered a continuous upgrading of occupational structure from 1870 to 1890, and concluded that "the great body of workers has, on the whole, progressed and has perceptibly risen in the social scale of life."

. . . .

Census data reached approximately their present state in the work of Alba M. Edwards. In 1917, Edwards proposed an expansion in the number of Hunt's classes and christened them "social-economic groups." He suggested a further revision in 1933, the format of which, unchanged in substance, comprises the conceptual basis for the data of the decennial Census. Elsewhere Edwards discussed the development and usefulness of the Census classification, and stated explicitly the goals of the social-economic groups. Their purpose is very sweeping in scope, and is not to simply summarize the types of jobs in the economy.[18]

It is understandable from this discussion why existing occupational classification systems are more appropriate for the consideration of broad questions of social progress than for analysis of the technical content of the jobs. Scoville concludes from his analysis that, ". . . the identification of groups characterized as much by their social station as their economic functions has been a major feature of United States statistics."[19]

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[18] J. G. Scoville, "Making Occupational Statistics More Relevant," *1965 Proceedings of the Business and Economics Statistics Section of the American Statistical Association*, p. 317. For a more detailed discussion, see James Scoville, "The Development and Relevance of U.S. Occupational Data," *Industrial and Labor Relations Review*, XIX, No. 1 (October, 1965).

[19] Scoville, "The Development and Relevance of U.S. Occupational Data," p. 71.

It should also be apparent that the issues which prompted the development of the socio-economic classification system are decidedly not the issues of today, so that a data classification system designed to answer the nineteenth century questions about social progress does not meet the needs of present-day efforts in the areas discussed above--manpower policy, occupational preparatory curriculum development, vocational guidance, industrial location, and even most special purpose studies. Two simple illustrations will suffice. In vocational guidance, a socio-economic system would presumably lead a counselor to encourage persons to enter the high status occupations; if such advice were followed, it would result in a surplus of labor in those prestigious occupations which do not carry high hiring requirements, and shortages in other equally important but less prestigious occupations. By the same token, a socio-economic system appears to be of little use to curriculum planning, because occupations of similar status may show no similarity whatever in type, or even length, of training. Moreover, the basic issues of occupational supply imbalances are completely obscured by such groupings.

Jerome B. Gordon reaches the same conclusion.

> Among labor force and manpower specialists, there is an increasing realization that the current classification is not

> providing useful information for a host of analytical areas . . . . There appears to be too little information on (a) the number of jobs available at different combinations of skill and wage levels, and (b) the number of workers possessing different skill levels at prevailing or expected wage levels. Hence, the current occupational structure falls down at precisely the point where the economist for one needs it--that is, supplying data on the range of substitution possibilities between occupational groups.[20]

Would a restructuring of occupational classification on some other basis preclude future sociological analysis of status? Hodge and Siegel, sociologists by training, conclude that,

> . . .while this particular need might best be met by revising the current major occupation groups into occupational classes homogeneous with respect to status and/or economic position, we do not feel that this need is urgent enough to offset the general disadvantages of the resultant heterogeneity of occupational groups with respect to task similarity of the specific jobs and detailed occupations aggregated to form its broad division.[21]

Thus, if choices must finally be made among incompatible aims occupational classification systems, it seems likely that status classifications could best be sacrificed. However, the conclusion some sociologists that organizational control is the best single easure of occupational status should be kept in mind, for some easure of organizational level has been shown to be relevant to her users of occupational data as well, and such a variable may e used to add a second dimension to a general classification system.

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[20] Jerome B. Gordon, "Occupational Classification: Current Issues and An Interim Solution."

[21] Hodge and Siegel, "The Classification of Occupations," pp. 185-186.

Worker Traits Occupational Classification Systems

Some of the severest criticism of the existing socio-economic ccupational classification systems is offered by psychologists and thers primarily concerned about the characteristics of workers, s distinguished from the characteristics of jobs. The systems resently in use do not classify information on the basis of such nventional worker traits as age, sex, color, family status, and ears of schooling, let alone such measures as aptitude, interest, chievement, and personality type. A major step in this direction as taken in the third edition of the D. O. T., where the U.S. nployment Service attempted to "reflect relationships among jobs t only in terms of the traditional work performed but also in erms of the requirements made on the workers . . . . Eight mponents were selected as significant for these purposes:) training time, (2) aptitudes, (3) interests, (4) temperaments,) physical demands, (6) work conditions, (7) industry, and of work performed."[22] This concern with worker traits represents a major departure from the conventional exclusive focus on job characteristics; moreover, it represents a large area of interest for policy and for vocational guidance, as the earlier analysis in Chapter II revealed. It is therefore appropriate to review the several work trait classification systems which have been proposed, and to evaluate them in terms of their usefulness of the entire range of occupational data needs.

Of all the various characteristics upon which worker trait systems could be based, only two have received much attention. Probably the oldest and most numerous are the systems which attempt to define occupationally relevant aptitudes and to classify occupations on that basis. The second general type are those reflecting the personal interests of workers, a type of trait, like aptitudes, for which tests have become available.

Like the various socio-economic classification systems discussed previously, the worker trait systems have been developed in one of two ways. Some principally reflect the judgment of the classifier, others are the result of the statistical analysis of empirical data. The influence of psychometric advances is very much in evidence in the development of many worker trait systems. The GATB aptitude system and the Strong Vocational Interest system are like Hatt's situses and Jerome Gordon's SES groups, principally the result of empirical analysis. Others are more akin to the Census, DOT, and I. S. C. O. in that they principally represent the judgmental application of defined classifying criteria. As Carroll Shartle points out, neither approach is without problems.[23] To measure the characteristics of existing employees empirically poses more than the usual research problems; it poses some conceptual problems as well. The employees who are in an occupation at any point in time reflect past labor market conditions as well as occupational requirements. This can mean that their characteristics are unrepresentative of actual requirements. However, the alternative, to estimate requirements, raises the problem of expert error. Thus, none of the various worker trait systems can be rejected on methodological grounds alone.

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[22] U.S. Department of Labor, Bureau of Employment Security, Dictionary of Occupational Titles, Vol. 1 (Washington, D.C.: U.S. Government Printing Office, 1965), p. 14. The first four components can generally be described as worker traits and the latter four as characteristics of the job station, although the interrelation of worker and job station obviously is at work in several.

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[23] Carroll L. Shartle, "Occupational Analysis, Worker Characteristics, and Occupational Classification Systems," in Henry Borow, ed., Man in a World at Work (Boston: Houghton Mifflin Co., 1964).

Occupational Classification Based on Aptitudes

Although there are numerous tests which purport to measure academic aptitude, there is only one broad-based test which has occupational aptitude as its primary focus, and that is the General Aptitude Test Battery (GATB) developed by the U.S. Employment Service. This test battery was originally developed from some 59 different aptitude tests. By taking the factors underlying the most valid tests, the U.S. Employment Service was able to reduce the number of tests to 12, which measure 9 aptitude factors. The 9 aptitudes measured by the GATB are:

G-- Intelligence: General learning ability, ability to grasp instructions and underlying principles. It is often referred to as scholastic aptitude, and is measured by three tests.

V-- Verbal Aptitude: Ability to understand the meaning of words and paragraphs, to grasp concepts presented in verbal form and to present ideas clearly. One test.

N-- Numerical Aptitude: Ability to perform arithmetic operations quickly and accurately. Two tests.

S-- Spatial Aptitude: Ability to visualize objects in space and to understand the relationships between place and solid forms. One test.

P-- Form Perception: Ability to perceive pertinent detail in objects or in graphic material, to make visual comparisons and discriminations in shapes and shadings. Two tests.

Q-- Clerical Perception: Ability to perceive pertinent detail in verbal or numerical material, to observe differences in copy, tables, lists, etc. It might also be called proofreading. One test.

K-- Motor Co-ordination: Ability to co-ordinate hand movements with judgments made visually; speed and precision. One test.

F-- Finger Dexterity: Ability to move the fingers and to manipulate small objects rapidly and accurately. Two tests.

M-- Manual Dexterity: Ability to move the hands easily and skillfully, a grosser type of movement than finger dexterity, involving the arms and even the body to a greater extent. Two tests.

Profiles for these aptitudes were included in the worker trait classification of the third edition D.O.T. described above.

While representing a somewhat different categorization, and supposedly limited to occupationally relevant aptitudes, this GATB list is not unlike the list presented by Super and Crites in their comprehensive review of human aptitude measurement. Super and Crites discuss the results of research in six areas of aptitudes:

1. Clerical. The clerical aptitude consists principally of perceptual speed.

2. Manual Dexterities. There are several manual dexterities. The GATB tests two.

3. Mechanical. There is not a "mechanical aptitude" per se; what is frequently described as mechanical aptitude has been shown to be a combination of spatial visualization, perceptual speed and acuity, and mechanical information.

4. Spatial Visualization. This is the ability to judge relationships of objects in space, i.e., to judge their shapes and sizes, to manipulate them mentally, and to visualize the effects of changing positions.

5. Artistic Ability. This complex ability is made up of six or more components, including aesthetic judgment and creative artistic ability.

6. Musical Ability. This is probably not a single aptitude, but a combination of others.[24]

(It is a curious fact that several of the six broad areas of aptitude measurement discussed by Super and Crites reflect occupational areas; suggesting, perhaps, the overriding importance of occupation in determining which basic human abilities are developed and subsequently defined and measured.)

Test norms for specific occupations have been developed from the component tests of the General Aptitude Test Battery. The specific occupations for which tests are available are, generally, the detailed occupations of the D.O.T. A review of the test data suggested that it would be possible to group occupations into a relatively small number of families for which aptitude requirements were similar; thus the individual occupational norms have been grouped into 35 categories called Occupational Aptitude Patterns (OAP's). There are two reasons for this grouping. First, determining an individual's qualification for a large number of specific occupations would be excessively time consuming, and, secondly, there is the conviction that good counseling requires some sort of grouping.[25]

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[24] Donald E. Super and John O. Crites, Appraising Vocational Fitness, (revised edition) (New York: Harper and Row, 1962), especially Chapters VII-VIII.

The OAP's were developed by grouping together occupations requiring the same three aptitudes, using cutting scores which were set at the median of the individual occupational scores. Other occupations have been added to these groups as job analyses showed them to be related.[26]

The GATB OAP's appear to represent a valid classification of occupations based on aptitude and would therefore seem to be a candidate for a general occupational classification system. However, despite the fact that they require similar aptitudes, the 35 OAP's lack homogeneity with respect to job duties, work environment, or other relevant variables. Dental hygienists and electronic icians are both found in OAP 5; auto mechanics and stereo- both fall in OAP 11; while file clerks and ticket agents are ified with nursery teachers in OAP 6.[27] These few examples suffice to demonstrate that the OAP's would be of little use outside ocational guidance, for they reflect too little commonality ng the jobs themselves to be used in determining the context vocational curriculum, in industrial location and wage decisions, for most policy questions.

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[25] Department of Labor, Bureau of Employment Security, *Guide to the Use of the General Aptitude Test Battery* (Washington, D.C.: Bureau of Employment Security, October, 1962), p. 101

[26] *Ibid.*, pp. 101-103.

Several things become evident from this review of aptitudes the one system which attempts to categorize occupations on the is of aptitudes. First of all, it appears that aptitudes themselves, least the individual aptitudes which have been defined, parallel a great extent the common functional designations regarding upations. Aptitudes such as "clerical," "manual," "mechanical," rtistic," and "musical" certainly have their counterparts in job ies. It has been demonstrated, however, that very few upations rely upon a single aptitude; consequently, combinations aptitudes must be considered. When occupations are grouped on basis of the three most prominent aptitudes, as was done in the P's of the GATB, the functional similarities seem to disappear, ving groups which are so diverse in job duties and skills that scriptive, occupationally based group titles cannot even be signed. It therefore appears that a particular set of aptitudes, from matching a specific occupation or types of occupations, appropriate to a wide variety of fields. As heartening as this y be for career choice, it makes aptitude patterns an unlikely y to portray similarities of occupations.

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[27] Ibid.

cupational Classification Based on Interests

Interests are the second type of personal trait sometimes ed to classify occupations. As with aptitudes, the occupational ssification is an outgrowth of recent psychometric advances in terest measurement. Probably the best known and most widely d of the interest tests is the Strong Vocational Interest Blank, which a person's score on an occupational scale indicates the milarity or dissimilarity between his likes and dislikes and the kes and dislikes which distinguish established members of that cupation from men (or women) in general. Strong's follow-research has shown that scores from groups of occupations have reasonably high predictive power. The groups are defined separately for men and women.

Another well known interest inventory is the Kuder Preference

Record, which uses ten groups in its vocational scoring key. Both the Strong and Kuder categories of interests, along with five others,[28] are discussed by Super and Crites under eight general categories. The following table lists Super and Crites' eight categories as well as their approximate counterparts in the Strong and Kuder scales.

A variation of the interest classification is the work of the psychologist Ann Roe, who presents a broad classification based on what she calls the "primary focus" of the occupation. Roe's description of the eight groups is summarized below.

> I. *Service*. These occupations are primarily concerned with serving and attending to the personal tastes, needs, and welfare of other persons . . . .
>
> II. *Business Contact*. These occupations are primarily concerned with the face to face sale of commodities, investments, real estate, and services . . . .
>
> III. *Organization*. These are the managerial and white collar jobs in business, industry, and government, the occupations concerned primarily with the organization and efficient functioning of commercial enterprise and of government activities . . . .
>
> IV. *Technology*. This group includes occupations concerned with the production, maintenance, and transportation of commodities and utilities . . . .
>
> V. *Outdoor*. This group includes agricultural, fishery,

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[28] The other five interest factors are those of Thurstone, Alport-Vernon, Lurie, Brogden, and Guilford. Super and Crites, *Appraising Vocational Fitness*, pp. 382-384.

CATEGORIES OF VOCATIONAL INTERESTS

Super and Crites	Strong		Kuder
	Male	Female	
Scientific--an interest in knowing the why and how of things	I. Biological Science II. Physical Science	VIII. Medical Sciences IX. Physical Sciences	Scientific
Social Welfare--an interest in people for their own sake	V. Social Service	III. Social Service VI. Domestic VII. Health-Related Services	Social Service
Literary--interest in the use of words and the manipulation of verbal concepts	X. Verbal-Linguistic	II. Verbal-Linguistic	Literary
Material--an interest in working with tangibles	III. Technical Supervision IV. Technical and Skilled Trades		Mechanical Outdoor
Systematic, Record Keeping--an interest in keeping records, computing, handling clerical details	VII. CPA Owner VIII. Business and Accounting	V. Business Clerical	Computational Clerical
Contact--interest in meeting or dealing with people for material gain	IX. Sales XI. President, Manufacturing Concern	IV. Sales	Persuasive
Aesthetic Expression and Appreciation--an interest in seeing or hearing works of art	VI. Aesthetic-Cultural	I. Music	Artistic Musical

Sources: Super and Crites, Appraising Vocational Fitness, p. 383; Edward K. Strong, SVIB: Strong Vocational Interest Blank Manual, rev. by David P. Campbell (Stanford, California: Stanford University Press, 1966), pp. 12-13.

> forestry, mining, and kindred occupations; the occupations primarily concerned with the cultivation, preservation and gathering of crops, of marine or inland water resources, of mineral resources, of forest products, and of other natural resources, and with animal husbandry . . . .
>
> VI. *Science*. These are the occupations primarily concerned with scientific theory and its application under specified circumstances, other than technology . . . .
>
> VII. *General Cultural*. These occupations are primarily concerned with the preservation and transmission of the general cultural heritage. The group embraces occupations concerning the subjects usually called the humanities in college catalogues, but it is broader than these. It includes occupations in education, journalism, jurisprudence, the ministry, linguistics, and so on . . . .
>
> VIII. *Art and Entertainment*. These occupations include those primarily concerned with the use of special skills in the creative arts and in the field of entertainment.[29]

It can readily be seen that Roe's eight categories parallel rather closely the seven types of interests discussed by Super and Crites and presented in the preceding table.

Of all the types of classifications discussed so far, the classifications of interest (including Roe's "primary focus") come closest to meeting the various needs outlined in the previous chapter. This is undoubtedly because the categories presented here have ining in terms of job characteristics as well as worker traits, thereby at least partially bridging the gap between the two types of interest in occupations.[30] In any case, it seems that the categories, if they were filled with specific occupations, would contain similar enough occupations that they could be useful for some vocational guidance, for some curriculum building, and for certain policy and research issues. An intermediate level of detail is missing, however, making application of this specific system difficult.

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[29] Ann Roe, *The Psychology of Occupations* (New York: John Wiley and Sons, Inc., 1956), pp. 145-147.

One of the greatest problems with these interest classification systems is the extremely disparate sizes which would appear once employment was classified on this basis. The category of "Science" and that of "Aesthetic Expression" (called Art and Entertainment by Roe) seem to contain few occupations of very small size, probably constituting only a small percent of total employment. Except for its educational component, the same thing can be said of Roe's Group VII, "General Cultural." On the other hand, Roe's Group IV, "Technology," and Super and Crites' "Material" appear contain the vast bulk of employment in the production, movement, and storage of goods. This one group must cover at least half of the work force. To be analytically satisfactory, a system should provide a more balanced distribution of cases. Despite this weakness, the types of categories contained in a classification of interests seem to be of potential general usefulness. This is in sharp contrast to the conclusion about the applicability of aptitude classification systems, and it raises some hope that a generally useful classifying principle can be found which will meet the variety of needs for occupational data while remaining relevant to at least some worker traits.

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[30] In the case of interests, as with aptitudes, one gets the distinct impression that the interests which have been defined or measured are those which have relevance for labor market activity. It remains a question for speculation whether the human interests which develop and are subsequently observed and measured do so in response to occupational opportunities, or whether mankind's fundamental interests are really independent of the types of activity in which people engage.

There remains the fundamental technical problem inherent in worker traits as a classifying principle, however. That is the problem not of what types of traits are to be considered, but what standard is to be used in measuring the worker traits of an occupation. As noted before, there can be substantial differences between observed traits, the minimum required traits, or the level desired by employers. While these distinctions are highly relevant, they are very difficult to make in practice, because worker trait requirements (hiring requirements) are both more difficult to measure and potentially much more flexible than job duties.

From this discussion, it appears that we have found a close k between one worker trait, interest, and the characteristics of bs. Although the collection and interpretation of worker trait data oses some extremely serious problems, as has been seen, the type of categories contained in Roe's "primary focus" system and n the more purely interest systems appear to have potential efulness in a general purpose system.

Curriculum Area Occupational Classification Systems

Efforts have recently been made to develop an occupational assification based on the concept that curriculum areas can serve s a basis for classifying jobs. These efforts stem from the renewed oncern with vocational education, which has generated a demand for nformation in which occupations requiring the same sort of reparation are grouped together.

One such system has been developed by the U.S. Office of ducation. That list of 20 curriculum areas contains seven ategories (marked with astericks in the list below) which are pposed to identify areas of occupational curriculum.

Curriculum Areas[31]

01*	Agriculture
02	Art
03	Business
04*	Distributive Education (Distribution and Marketing)
05	English (Language Arts)
06	Foreign Languages
07*	Health Occupations Education
08	Health and Safety Education, Driver Education, Physical Education, and Recreation.
09*	Home Economics
10	Industrial Arts
11	Mathematics
12	Music
13	Natural Sciences
14*	Office Occupations
15	Social Sciences/Social Studies
16*	Technical Education

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[31] U.S. Department of Health, Education, and Welfare, Office of Education, *Standard Terminology for Instruction in Local and State School Systems* (Third Draft) (Washington, D.C.: U.S. Office of Education, 1967).

17* Trades and Industrial Education

18 General Elementary Education and General Secondary Education.

19 Differentialized Curriculum for Handicapped Pupils

20 Co-curricular Activities

The list clearly reflects historical curricular organization better than it does the labor market. "Home Economics" is identified as vocational, while "Business" is not; the outdated "Trades and Industry" category can only be extremely heterogeneous. Finally, there is no category for the occupations in social services, food service, and transportation.

Unfortunately, the desire to relate types of occupations and curriculum areas has led to some confusion of the dependent and independent variables. Whereas the intent of vocational curricula is to relate education to the labor market, curriculum area classification systems propose to classify occupations in terms of the established areas of curriculum specialization. This approach makes the Procrustian error of attempting to fit the labor market to the existing education structure. Thus, it contains the inherent danger of failing to describe the labor market so much as the institutional arrangements of schools, which are supposed, among other things, to be reflecting labor market needs in their curricula.

Another weakness of such a system is also illustrated here. Attempts are made to draw a distinction between academic subjects (English, mathematics, safety) and vocational subjects (technical, office, health occupations), but no such distinction exists in the labor market. A certain proficiency in English, mathematics, and safety are specific requirements for many occupations, just as proficiency in drafting, bookkeeping, and welding are required.

Such systems often go even further in limiting the learning they consider to be relevant. By purporting to define the "teachable content" of jobs, they exclude sometimes necessary skills which are not judged to be "teachable" in a classroom setting. Unfortunately, the so-called "teachable content" of jobs usually turns out to be the technical skills, while the social skills which are sometimes more important are omitted from consideration. A classification system based on such a limited view of things obscures similarities and misses the essential characteristics of many jobs.

Another great weakness of such a system is the premise that immutable curricular requirements for occupations can be defined, while in fact there is great variety in the ways occupational preparation can and does occur. With the exception of regulated occupations where the means of entry into the occupation is restricted by force of law, a person can prepare for almost any occupation in a variety of ways. The substitution of relevant experience for formal education is a common practice, while the specific educational or experience requirements are even more variable. Any classification system must recognize that "substitution exists in two directions: sometimes one occupation can be held by people with different types of education; in other cases with the same type of education one can find employment in various occupations."[32]

In this regard, the International Labor Office recognized that a worker's occupational qualifications, "or the combination of skill, knowledge and ability which he brings to his work," are relevant to an understanding of occupations, but they judged occupational preparation not to be a suitable classifying criterion because ". . . firstly, occupational qualifications are not absolute, and secondly, their measurement is frequently a matter of judgment."[33]

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[32] Jan Tinbergen, "Employment Forecasting and Planning," in Organization for Economic Co-operation and Development, Employment Forecasting (Paris: OECD, 1962), p. 16.

[33] International Labor Office, International Standard Classification of Occupations, p. 3.

In conclusion, it seems that a curriculum area occupational classification system has little to recommend it. As has been seen, it reverses the dependent (curriculum) and independent (occupation) variables; it tends to omit major areas of knowledge and skill which are occupationally relevant; and it implies an absoluteness in the means of occupational preparation which is not the case. Fortunately, not even vocational education requires such a classification system. The conceptualization of such categories as Health Occupations and Office Occupations demonstrates that an occupational rather than a curricular basis can be used in a system which is appropriate for curriculum planning. Thus it seems appropriate to reject curriculum areas as a potential classifying principle, even for vocational education curriculum planning, and to look to the more basic characteristic, job content. To deny the appropriateness of curriculum areas as a basis for classifying occupations is not to reject vocational education; the conclusion here is simply that some job or worker characteristic is a more appropriate classifying principle.

CHAPTER IV

AN ALTERNATIVE: THE FUNCTIONAL CLASSIFICATION OF OCCUPATIONS

The preceding chapter discussed alternative occupational classifications with the two-fold purpose of evaluating their strengths and determining what variable is most likely to provide a generally useful basis for classifying specific occupations into analytical categories. Three general types of systems were reviewed--the socio-economic systems, the worker trait systems, and the instructional area systems--and not one of them showed itself to be satisfactory as a general purpose system. For one thing, none provided the three levels of detail judged necessary for such a system. More importantly, none was based on a classifying principle which seemed to meet the criterion of broad usefulness. Of the three types, the instructional area systems had the least merit. They are very limited-purpose systems based on an inadequate conceptualization of the relevant content of jobs and defined in such a way that their application would be unverifiable. Of the three types, only the conventional socio-economic systems are in actual use for data presentation. As was seen earlier, these systems have been criticized in both their conceptualization and application. While these systems have the merit of being the basis for current and historical data presentation, the current wave of criticism stimulates the search for a better alternative. Standing as a fairly extreme alternative are the worker trait systems, most notably the classifications of aptitudes and interests. Upon close examination, however, these categorizations seem mostly not to satisfy the variety of needs for analytical groupings of occupational data, and they seem to be very difficult to apply as well. Thus, the conclusion of this review is that no satisfactory general-purpose system or classification principle is to be found among the existing alternatives. Even so, it is possible to conclude that, despite historical failures, a general-purpose classifying principle will be one which identifies job families on the basis of some characteristic of the job, rather than characteristics of the workers filling the jobs. There are three main reasons.

First, the job characteristic systems come closer than the worker-trait systems to meeting the needs of general policy, curriculum planning, industrial location and wage determinations, and special studies. For the most part, worker-trait systems prove truly relevant only to vocational guidance. The second advantage of the job characteristic systems is their ready applicability. Much information about jobs is already available in specific occupational definitions, and existing occupational analysis techniques permit information to be gathered at acceptable cost. The measurement of worker traits, on the other hand, has not as yet progressed very far, and would require a great deal of basic research as well as data collection before a large volume of usable data were available. A third advantage of a job characteristic system is that it avoids the fundamental difficulty of distinguishing among required, desirable, and existing characteristics, a problem which plagues descriptions of worker traits.

Discussing the advantages of a system based on characteristics of the job is not to deny the value of either occupational level and/or worker traits in describing occupations. Quite the contrary, experimentation with alternative operational definitions for levels would be highly appropriate as would refinement of the various worker trait groupings. The point is simply that a classification system based upon some characteristic of the job is probably more broadly useful, more readily applicable, and more verifiable than any of the others, and should, therefore, be pursued.

Definitive statements of occupational classification needs have not been made, so it was necessary for us to infer needs from the available literature in the several fields of labor economics, guidance, sociology of occupations, and vocational education. Moreover, very little rationale is given to support the various systems which have been proposed, so it is difficult to evaluate them. In reviewing the literature in the various data using fields and in studying the literature on occupational classification, one is struck with the frequency with which a common suggestion is made, though not pursued.

James Scoville says,

> Two major aspects of jobs can be identified which serve to describe their job content--the principal technical, material, or functional focus, on the one hand, and the level of complexity on the other. The first dimension thus, places the job in a family of jobs centered about some characteristic function of "locus of attention."[1]

Ann Roe says that occupational groups should "indicate the primary focus of activity in the occupation."[2] And, like Scoville, she defines level as a second relevant variable.

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[1] James G. Scoville, "Making Occupational Statistics More Relevant," 1965 Proceedings of the Business and Economic Statistics Section of the American Statistical Association, pp. 319-[illegible].

[2] Ann Roe, The Psychology of Occupations (New York: John Wiley and Sons, Inc.,), p. 144.

Carroll Shartle asks,

> . . . why not use worker traits? This was tried experimentally and it was found that more meaningful categories developed when the initial sort was based on worker functions.[3]

The significance of a functional classification of employment for economic analysis is indicated by Victor Fuchs in his study of The Growing Importance of the Service Industries. In attempting to determine the consistency of the rapid growth of services, he says,

> A second question concerns the extent to which a classification of employment by function instead of industry would confirm the existence of a trend toward services. We do not have employment data by function, ...[4]

Eleanor G. Gilpatrick, in the Monthly Labor Review, also talks of "classifying job functions."[5]

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[3] Carroll L. Shartle, "Occupational Analysis, Worker Characteristics, and Occupational Classification Systems," Man in a World at Work, ed. by Henry Borow, p. 304.

[4] Victor R. Fuchs, The Growing Importance of the Service Industries (New York: National Bureau of Economic Research, 1965), p. 4.

[5] Eleanor G. Gilpatrick, "A Proposed System of Occupational Coding," Monthly Labor Review, XCI, No. 10 (October, 1968), p. 50.

The term "function" or some similar term appears in statements by writers from many fields with interests in occupational classification, though the concept has never been developed and used as a basis for occupational classification.[6] The wide-ranging use of the term suggests that the concept of job function might serve as the basis for a generally useful classification system.

To take an elementary example of the application of the concept of function to occupations, one would say that, in a general economic or social context, the principal function of physicians is to provide health services, which is the same function performed by dentists, registered nurses, dental hygienists, licensed practical nurses, and nurse aides (the difference between physician and nurse aides being one of level). Similarly, the function of executives and other officials in most organizations is to provide management control. This context involves standard usage of the term. Webster's New World Dictionary defines function as "a special duty or performance required of a person or thing in the course of work or activity: as, function of a policeman is to protect and assist the public."[7]

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[6] The term has been used with reference to certain worker trait groupings in the third edition of the DOT, but the concept is really not one of "function," but one of "relationships" of workers in the occupation--to other people, to data, and to machines and tools.

Although the concept of job function has not received precise definition in the literature, the contexts of the comments quoted above and the types of needs for occupational information which have been identified make it seem most reasonable to pursue this concept as a possible general-purpose classifying principle.

This classifying principle is one which classifies occupations on the basis of job characteristics, but it focuses on the dominant activity, or central job duty, not on an overall skill level or on some variable which is of little significance to some occupations. The conceptual simplicity of the "function" principle makes it readily definable and easily understood. Partly for these reasons this classifying principle avoids many of the problems which plague occupational classification systems. It involves a rather general concept, but one which is not a conglomerate of several specific characteristics; therefore, it avoids one of the serious problems of the socio-economic classifications which attempt to be comprehensive by intermingling a number of separate features. "Function" also has the advantage of being a central characteristic of all occupations, and it is one which, in the vast majority of cases, can be readily identified for classification. Such characteristics as education are poor classifying principles precisely because, while they are very important to some occupations, they may indicate secondary, or even irrelevant, characteristics for others.

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[7] Webster's New World Dictionary of the American Language, College Edition (Cleveland and New York: The New World Publishing Company, 1966), p. 586.

The concept of function is also highly compatible with the "job duties" basis on which specific occupations are defined. This fact is of great operational importance. It vastly simplifies the process of categorizing occupations, because the information necessary for an occupational definition is also sufficient for classification of the occupation into the analytical classification system. "Function" also has the advantage of flexibility with regard to level of detail. Various compatible levels of detail are possible, from a few broad groups at one extreme to specific occupations at the other. (The levels of detail suggested later are the ones which were judged most appropriate in Chapter II--five broad functional groups, about 20 intermediate categories, and the specific occupations). Thus, the concept meets the first two criteria specified earlier--it is based on a characteristic of the job, and it is adaptable to three levels of detail.

The fact that occupational functions can be defined readily more than one level of detail is of operational as well as analytical portance. Employment data tend to be of highly variable quality, ing precise occupational designations impossible in some cases. e ability of a functional classification system to reflect various els of detail makes it possible, through the use of an appropriately structed coding system, to deal with various pieces of informa- n at their own levels of significance, omitting finer details and oiding the illusion of accuracy when it is not present. As will be n later, this is an especially important capability when original a accumulation involves frequent, sizable surveys of either ployers or households.

There are other advantages to the functional classification of pations which will be described and, where possible, documented ater chapters. At that time further discussion of the advantages he functional classification of occupations for the processing of ployer survey data will be discussed, and research will be rted which compares the reliability of functional coding with Dictionary of Occupational Titles socio-economic group coding. at a later point we shall examine a number of analytical issues ch illustrate the power of this coding system to reflect some rtant structural characteristics of the labor market and to ght developing labor market trends. All of that, however, requires that the content of a functional classification of occupations be specified. That is the purpose of the next section.

A Provisional Functional Classification of Occupations

It should be pointed out immediately that the system described here is strictly an analytical system, i.e., it does not include definitional criteria for the basic units, occupations. (It was noted earlier that one of the operational advantages of function as a classifying principle was that it permitted use of the existing job-duty based occupational definitions). The detailed occupational definitions used here are based upon the Dictionary of Occupational Titles, Volume I.[8] While the full twenty-two thousand detailed occupations could be fit into this Functional Classification System, the definitional detail actually used is a somewhat broader grouping consisting of several hundred specific occupations. This detail was originally used on the definitional level to facilitate coding, processing, and analyzing employer-survey based data. It was argued earlier that such a detail is the finest feasible level and is re suitable for most purposes than the twenty-two thousand ecialized categories of the DOT. The choice of definitional ts need have no substantive effect on the analytical classification, owever. Since the interest here is in the analytical system, it is fficient to note that either level could be employed for definitional rposes. In fact, both could be used, with the finer considered as dentifiable but unquantitied specialities within the several hundred cupational categories used for basic data coding.

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[8] U.S. Department of Labor, Bureau of Employment Security, Dictionary of Occupational Titles, Vol. I, 3rd ed. (Washington, D.C.: U.S. Government Printing Office 1965).

Given job-duty based definitions for the specific occupations, w are occupations to be categorized? As noted previously, a nctional Classification of Occupations has the advantage of ibility with regard to level of detail. Various compatible levels etail are possible, from a few broad groups at one extreme to ecific occupations at the other. As used here, the classification stem includes 5 broad functional groups, about 20 intermediate job sters, and several hundred specific occupations (with the option identifying occupational specialities remaining as a further reakdown of the specific occupations). It may be useful to look at slightly modified version of Figure 1 to clarify the relationship.

Occupations.--At the detail level are the specific occupations, cated in Figure 2 by Arabic numerals. The concept of occupation d here is the standard one for occupational definitions based on

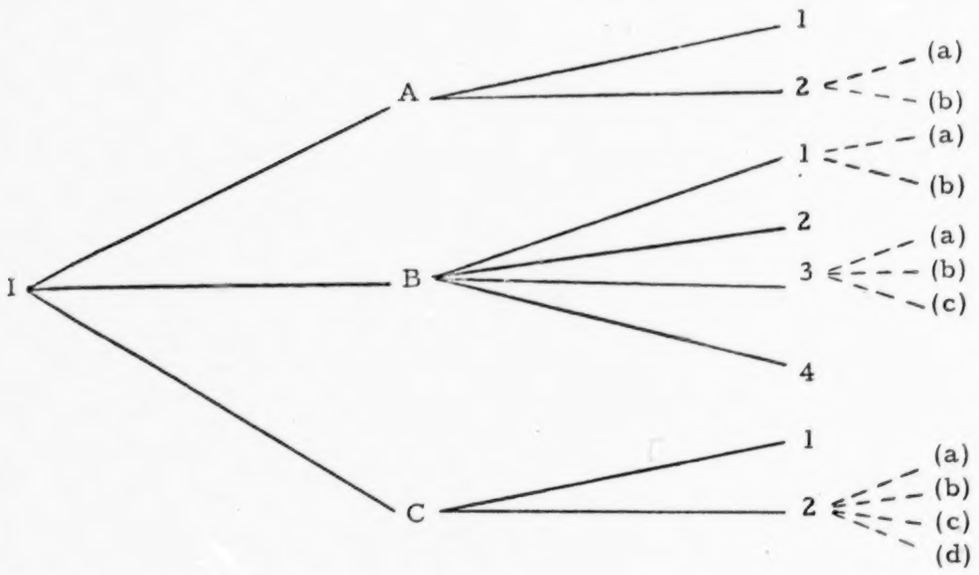

Fig. 2.--A hypothetical occupational arrangement showing a functional group (I), occupational clusters (A-C), and detailed occupations (1-4), with occupational specialties (a-d) indicated

job duties. Jobs are identified as comprising an occupation when they exhibit like job duties. They can normally also be expected to perform at about the same level of difficulty or responsibility and to require about the same skills, knowledges, and physical characteristics. In practice this level of detail identifies several hundred occupations such as welder, dentist, and sales clerk. This is the finest level at which occupational data are actually presented. Definitions are essentially those from the existing

Dictionary of Occupational Titles; the titles selected are those which best represent the job duties of the occupation and conform with local practice.

Occupational Specialties.--The U. S. Department of Labor has succeeded in identifying some twenty-two thousand specialized types of jobs in the *DOT*. It is impossible, and for most purposes unnecessary, to attempt to quantify occupational detail at that level, but it is sometimes useful to be able to indicate occupational specialties. Occupational specialties can be characterized as jobs within an occupation, which, while exhibiting like job duties to other jobs in the occupation, require a somewhat specialized application of the occupation's skills and knowledges, as a "mechanical" draftsman is a specialized kind of draftsman. Falling in the category of occupational specialties would be the eight types of welders identified by the *DOT* and the various specialists in the other occupations.

Efforts are now being made to standardize terminology and to group detailed *DOT* occupations into categories of about the detail suggested here. The federal government's Technical Work Group on the Classification of Occupations, is establishing a two- and three-digit system into which *DOT* detailed occupations fit. While the broader analytical structure of these codes remains socio-economic status in principle, the distinctions made at the detailed level parallel the distinction and relationship between "occupations" and "specialties" just described.[9]

Occupational specialties are indicated in Figure 2 by dotted lines to indicate that they can be identified, but generally not specified.

Clusters.--This is the first analytical grouping of occupations, and is indicated in Figure 2 by the upper-case letters, A, B, and C. A cluster is a group of occupations which share a common, fairly specific function such as providing health services, producing agricultural commodities, or administering an organization, but the occupations within a cluster are not highly substitutable for each other (sometimes only because they perform at different levels of responsibility). Occupations within a cluster do share a substantial common core of skill and knowledge and are frequently interrelated by production process or work environment, and that is the important consideration of the clusters. All told, the system presented here includes twenty-some job clusters; however,

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[9] Letter from Milo O. Peterson, Chairman of the Technical Work Group on the Classification of Occupations, Office of Management and Budget, Executive Office of the President, January 12, 1971, and working drafts of professional and clerical occupation classifications.

It is recognized that additional clusters can be identified. This, as can be seen readily, is the intermediate level of detail thought to be so useful in vocational education curriculum planning and in vocational guidance, as well as in manpower policy considerations.

"Health services," is an easily comprehended example of a cluster of occupations (sometimes called the "health service team"), which share a common function, in this case the delivery of health services. The cluster includes a number of occupations with distinguishable job duties: physician, dentist, nurse, nurse aide, etc., each of which may have a number of specialities which could be identified.

Functional Group.--Beyond the fairly specific occupational clusters are the broad functional groups. These are indicated in Figure 2 by Roman numerals. Functional groups indicate where each of the clusters fits into the broader economic pattern of production, distribution, and exchange of goods and services. Functional groups are most useful for an analytical overview of labor market conditions and trends, and are therefore relevant to introductory educational programs as well as to general manpower policy issues. As will be seen later, one of the advantages of this functional categorization is its ability to highlight developments in the labor market of significance to the manpower issues of the day.

The Functional Classification of Occupations described here divides the job spectrum into five major functional groups: Organization Management, Technical Services, and the three traditional categories of Production, Distribution, and Direct Service. Economically the functions are clearly definable. Organization Management has the function of *direction and control*; the Technical Services group provides specialized *technical support* services for the other groups; Production, the *processing* of goods; Distribution, the function of *distributing* goods to markets; the Direct Service group has the function of providing services *directly* to people.

Throughout the construction of the system, judicious efforts have been made to avoid grouping occupations by *level* as in a socio-economic occupational classification system, or by type of enterprise as in an industrial classification system. (Both level and industry are useful but properly independent classification principles.) The intent has been, instead, to group together those jobs which have common functions and, in the job clusters, those which share a common cluster of skill and job duties. Such a system inevitably parallels one of the other types of systems through part of its structure. Thus it will be noted that certain clusters take their nature and their title from an industrial system and others from the older occupational systems; on the other hand, still others are unique. Despite these apparent similarities, each is a clustering of occupations which seem most characteristically to orbit around a particular function.

A full understanding and assessment of the principle of the Functional Classification of Occupations requires some specification. One such specification is presented here. The conclusion that a functional classification is perhaps the most generally useful way of categorizing occupational information is not dependent upon the total acceptance of the example developed in this chapter, however. It goes without saying that the detailed specification of such a system requires a great amount of work; more than can be devoted here. So, while the following is thought to represent the outline of a Functional Classification of Occupations, details could be altered without in any way diminishing the utility of the principle.

One further note of explanation should be made with regard to particular formulation of the functional classification. A variation of it was developed about five years ago for a study of vocational education needs in the Eugene, Oregon Standard

Metropolitan Statistical Area.[10] That system grouped pre-existing occupational data.

Since that time the system has been used as a basis for curriculum planning and for other purposes in the area, and has been reviewed and amended on the basis of that experience. Thus, while it principally reflects the conceptualization of the author, it also incorporates at least some operational experience. It should also be noted that the following listing of clusters and their component occupations is admittedly somewhat tentative. While it is based on actual occupational employment data and has been used for program planning, it is still subject to refinement and amendment. This is especially important to remember because the data used are those for the Eugene, Oregon Standard Metropolitan Statistical Area, not for the nation as a whole or for all major SMSA's. Thus, while Eugene has a fairly representative occupational profile, it is not a micro-model of the country as a whole, so some extension of this clustering would be required, especially in production, to incorporate activities not found in this area. That elaboration should require very little modification of defined clusters, only the addition of some new ones.

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[10] See Lane County Intermediate Education District, Job Cluster Curriculum (Eugene, Oregon: Lane County Intermediate Education District Board of Education), 1965.

1. Organization Management Functional Group

The function of organization management occupations is to provide direction and control for a specific establishment or production unit such as a plant, warehouse, hospital, or laboratory. Occupations and job clusters that serve this function play a two-fold coordinative role: to achieve efficiency within the organization and responsiveness to developments outside the organization. Record keeping, communications, and decision making are the principal activities of the occupations in this group. This functional group includes a large number of the occupations which have no special industrial attachment, in that they are found in nearly every organization's administrative office. Management of an organization requires a system for obtaining reliable information and for communicating decisions. Three clusters of occupations are involved in performing this function--administrative occupations, clerical occupations, and bookkeeping-accounting occupations.

A. Administrative Cluster.--The administrative cluster includes occupations whose principal function is the administration of an organization. Principal activities include decision making, coordination, supervision, and the provision of certain staff services such as personnel management. Occupations are included in this cluster if their principal activity is managerial rather than production. The distinction made here between managerial and production workers is common, though sometimes difficult to make in practice, and it reflects the different functions of the two types of occupations.

As can be seen from the list below, this is a relatively small cluster in which a premium is placed on skills acquired through actual job experience. All of the occupations in this cluster require more than a year's preparation, and place a heavy premium on experience.

Principal Occupations

Office Managers

Transportation and Warehousing Firm Managers

Service Organization Managers

Public Utilities Managers

Advertising and Public Relations Men

Finance Managers

Department Managers

Personnel Managers

Buyers and Purchasing Agents

Production Superintendents

B. Clerical Cluster.--The occupations in the clerical cluster exist principally to facilitate communications within and between organizations. This is a generally recognized category of occupations and one which appears in most occupational classification systems under the same title. The clerical occupations share a basic core of skills, though they are combined in so many and varied ways that it is often difficult to distinguish one occupation from another, especially from job titles alone. This is one of the larger clusters.

Principal Occupations

General Office Clerks

Clerk-typists

Receptionists

Messengers

Stenographers

Secretaries

Telephone and Telegraph Operators

C. Bookkeeping-Accounting Cluster.--Bookkeeping and accounting occupations constitute the third component cluster of the organizational management function. The occupations in this cluster are principally involved with maintaining and processing the office records which are required for effective management.

Increasing numbers of these jobs involve working with computers and other office machines. Some thought was originally given to designating a separate "computing" or "office machines" cluster. One reason for not doing so was the fact that most computer installations are for "business" application rather than "scientific" application, so the vast majority of persons in computer-related occupations are involved with bookkeeping and accounting functions. An additional reason for including computing machine occupations in the Bookkeeping-Accounting Cluster, at least for the present, is that employment in computer-related occupations is still small in comparison with the other groups of occupations which are designated as clusters.

Principal Occupations

Treasurers

Accountants

Auditors

Bookkeepers

Loan Officers

Credit Managers

Cashiers

Bank Tellers

Railroad Clerks

Order Clerks

Credit Clerks

Office Machine Operators

Systems Analysts

Programmers

Key Punch Operators

Computer Operators

II. Technical Service Functional Group

The function of the technical service occupations and job clusters is to provide specialized technical support services for the other major functional groups. Such technical service clusters as planning are often closely tied to management, but others are more closely associated with particular production, distribution, or service activities. While these occupations usually have close working relationships with occupations in other functional groups, they are distinguishable by their application of some specialized skill to facilitate the accomplishment of the other occupations' functions by the solution of technical problems outside the normal scope of the other occupations' job duties. Because technical competence is the necessary characteristic of technical service occupations, these occupations frequently involve substantial independence of judgment.

The use of the term "technical" here should not be confused with its usage in socio-economic classifications where "technical" denotes a semi-professional level of occupational competence, responsibility, or status. The Technical Services Functional Group appearing in this classification includes a variety of skill levels, as do most of the functional groups (as was pointed out earlier, occupational level is an important but separate designation). The occupations included in this functional group are distinguished by their particular technical support function, not by their skill level, although many of the occupations in this category are engaged in the operation or maintenance of highly-sophisticated technology and are, therefore, relatively new. Those occupations are also expanding rapidly.

Of the five broad functional groups in this classification system, this is the one which has not traditionally been separately identified. Nevertheless, these occupations appear analytically to serve a distinct function, and it is increasingly common to find them separately organized in research, engineering, mechanical, maintenance, or similar non-production units. The identification of a separate Technical Services Functional Group appears, then, to be not only analytically useful, but also descriptive of the actual organization of occupations in establishments.

A. Social Research and Planning Cluster. Advances in social science research and planning methodology, together with the increasing recognition of social problems at all levels, is beginning to generate a demand for social research and planning personnel. The function, of course, is the identification, analysis, and reporting of social problems and other social phenomena, and, perhaps, the planning of corrective action, whether the problem is one affecting personnel at the firm level, police relations at the city level, or poverty at the national level. Occupations in this cluster obviously relate closely to occupations in the Social and Protective Service Clusters and to the Administrative Cluster; however, their functions are not the delivery of service or the management of one organization, but the analysis of a problem and the planning for its solution.

Employment in this cluster is as yet extremely small, and the character of many of the occupations has not as yet become very clear.

Principal Occupations

Economists
Psychologists
Personnel Consultants
Sociologists
Program Planners

B. Engineering and Design.--Occupations in this cluster apply engineering and related scientific skills to the design of buildings, roads, utility lines, and other structures. This is already a rather clearly defined job family with occupations at a variety of skill levels from engineering aides to engineers. There seems to be a movement among architects and, to some extent, among engineers, broaden their functions from strictly resolving detailed structural sign problems to larger-scale planning efforts which include plicit attention to ecological and aesthetic considerations, activities which have traditionally been left to urban planners. The function of this cluster, then, includes a somewhat broader definition of planning than has been customary in thinking about the work of engineers and architects. The overall similarities of duties, as well as the methods, and to some extent the technical skills of these occupations are sufficient to warrant the broadening of this cluster to include urban planners rather than the identification of a separate cluster.

Principal Occupations

Engineers

Engineering Technicians

Engineering Aides

Urban Planners

Surveyors

Architects

Draftsmen

C. Laboratory Science Cluster.--These occupations use technical laboratory skills to perform tests for quality control, diagonistic, and research purposes. Principal disciplines employed are those of the physical sciences with the principal function being that of testing and analysis. A good many of these occupations are closely tied to the delivery of health services, while others are organizationally and industrially linked with various production processes. Their functions are not direct service or production, however, but the provision of a specialized technical service.

Principal Occupations

Chemists
Laboratory Testers
Biological Scientists
Physicists

Medical Technologists
Laboratory Assistants

D. Mechanical Cluster.--The mechanization of many facets of economic activity has generated a need for technical services in the adjustment and repair of equipment used in management, production, distribution, and direct service. Maintenance and repair of all sorts of mechanical equipment is the function of this cluster. The Mechanical Cluster seems to contain three types of occupations: automotive, heavy industrial machinery, and small machinery. They appear in one cluster because they perform the same functions and use many of the same basic skills. The work environment is usually a repair shop. This cluster, like many others, includes occupations at a rather wide variety of skill levels from heavy-duty mechanics to service station attendants.

Principal Occupations

Truck, Bus, and Heavy
  Equipment Mechanics

Automobile Body Repairmen

Automobile Mechanics

Railroad Mechanics

Industrial Machinery Repairmen

Instrument Repairmen

Service Station

New Car Get-Ready
  Men

Oilers

Millwrights

Office Machine
  Repairmen

Radio and Television
  Repairmen

E. Building Maintenance Cluster.--These occupations perform a function similar in many ways to those of the Mechanical Cluster, in that their principal function is maintenance and repair; however, they are involved in the maintenance and repair of buildings rather than machinery. It seems appropriate to classify them separately, because the particular technical skills they employ tend to be substantially different than those of mechanical equipment repairmen. In fact, many of the skills are those of the building trades, but the principal activity is maintenance and repair rather than construction.

Principal Occupations

ing Maintenance Men

tors

n-up Men

sekeepers

Building Superintendents

Car Cleaners

Maids

The inclusion of certain of these occupations in a Technical rvice Cluster raises some question, not because the technical lls involved in the cleaning occupation, while they do exist, are extremely high, but because cleaning may not appear to be a lding maintenance activity. Cleaning occupations clearly do t belong in any of the other functional categories, however, and ey do perform the same sort of staff service function as most the other technical service occupations. Moreover, many of e skills involved in building maintenance and building cleaning are e same, and a large number of positions actually involve both tivities.

Production Functional Group

The principal function of this broad group of occupations is ar and has been traditionally recognized: the production of ods, of course, occurs in a variety of stages at which raw materials, intermediate goods, or both, are processed. This functional group obviously includes most of the production workers in the manufacturing, agricultural, and construction industries.

The traditional occupational classification of production workers is in terms of level: skilled, semi-skilled, and unskilled. More recently, in the third edition of the DOT, an alternative is used which categorizes production occupations not on the basis of their skill level, but on the basis of broad activity types. These are: processing, which includes "refining, mixing, compounding, chemically treating, heat treating, or similarly working materials and products,"[11] machine trades, which involves ". . . feeding, tending, operating, controlling, and setting up machines to cut, bore, mill, abrade, print, and similarly work such materials as metal, paper, wood, and stone,"[12] and bench work, which involves ". . . the use of body members, hand tools, and bench machines to fit, grind, carve, mold, paint, sew, assemble, inspect, repair, and similarly work relatively small objects and materials . . . ."[13]

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[11] U. S. Department of Labor, Bureau of Employment Security, Dictionary of Occupational Titles, 3rd ed., Vol. II, p. 84.

[12] Ibid., p. 121

[13] Ibid., p. 150.

This DOT classification is a major step in the right direction, in that it attempts to identify job families, rather than attempting to arrange occupations in a single skill-level hierarchy; however, it proves rather difficult to apply in that the differences in the man-machine interface from one group to another is not always readily ascertainable. This classification scheme is also handicapped by the fact that some very important occupations with substantial employment do not fit the schema, and are assigned to a rather heterogeneous "miscellaneous" category.

The types of job clusters which seem best to reflect the functions of the various production occupations are essentially industrial in nature. They take their function, say the production of automobiles or the processing of food stuffs, from the particular type of good produced, just as direct service clusters take their function from the service rendered. These occupational clusters are, of course, not co-extensive with the industry that may share the same name, because the clusters include only the occupations directly involved in the main production process, excluding office, maintenance, sales, and other associated activities. Clustering production jobs on this basis has the advantage of reflecting the common work environment of workers within the various clusters and the relatively strong industrial attachment of production workers. It is this latter fact which, probably more than anything else, justifies the use of the product produced as a basis for identifying the function of production clusters.

A. Agriculture and Forestry Cluster. --The function of this cluster is the production of food and horticultural crops. Included are the related areas of animal husbandry, the raising and harvesting of food stuffs, the production and care of ornamentals, and silvaculture. While the actual product varies, there is considerable commonality in the basic knowledge requirements as well as the work environment, and agriculture is commonly recognized as an activity type.

Principal Occupations

Farm Operators
Farm Hands
Grounds Keepers
Foresters
Farm Managers
Gardeners
Tree Trimmers
Forestry Aides

B. Food Processing Cluster. --Occupations in this cluster serve the function of processing raw food stuffs such as meat, dairy products, fruits and vegetables, as well as bottled drinks and other prepared foods prior to consumer marketing.

Principal Occupations

General Food Processors
Cannery Workers
Bakers
Butchers and Meat Cutters
Packing House Workers

C. Timber Products Cluster.--The function of this cluster is the harvesting, milling, and processing of timber into such products as dimension lumber, plywood, particle board, pulp, and paper. Whereas this activity traditionally stopped with the harvesting and milling, recent developments have seen a major extension in the processing of the raw material. The organization, and to some extent the staffing, of these activities is sufficiently integrated that their combination in a single cluster seems most appropriate.

Principal Occupations

Hook Tenders
Chokersetters
Head Loaders
Deckmen
Sawyers
Lumber Graders
Logging Foreman
Fallers and Buckers
Yarder Engineers
Barker Operators
Edgermen
Planermen
Chasers
Whistle Punks
Second Loaders
Pondmen and Slipmen
Trimmermen
Stacker Operators

Principal Occupations--Continued

- Lumber Checkers
- Clipper Operators
- Chippermen and Hog Feeders
- Sheet Turners
- Shake Packers
- Sawmill and Plywood Laborers
- Lathe Operators
- Dryer Tenders
- Core Feeders
- Veneer and Finish Patchers
- Lathe Spotters
- Chainmen
- Drier Feeders
- Core Layers
- Sander Operators
- Plywood Laborers

This is one of the regionally localized production clusters which is highly significant in the Pacific Northwest and the South, but might not warrant separate identification in other regions. In those regions other production clusters would deserve separate identification. Such regional specialization is apparent only within the production functional group.

D. Construction Cluster.--Construction occupations serve the function of producing buildings and other structures. Principal activities include the handling, assembly and application of building materials, and to some extent the operation of construction equipment.

(The operation of trucks, caterpillars, and other mobile, materials-moving equipment is classified in the transportation cluster.)

This is a traditional grouping of occupations which share a common work place, which face the same problem of seasonality, and in which there is strong craft organization of the labor force. For these reasons they are grouped together, despite distinct technical skills.

Principal Occupations

- Construction Superintendents
- Crane Operators
- Logging, Tractor, and Bulldozer Operators
- Construction Workmen
- Bricklayers
- Carpenters
- Roofers
- Construction Foremen
- Powdermen
- Plumbers
- Plasterers
- Cabinet Makers
- Glaziers
- Insulation Installers
- Operating Engineers and Construction Equipment Operators
- Painters
- Crane Helpers
- Cement Masons
- Floor Layers
- Furnace Installers

E. Electricity-Electronics Cluster.--Occupations in this cluster employ the technology of electricity for the generation, distribution, and use of electrical power and for the construction, installation, and maintenance of electronic equipment.

Electricity and electronics occupations provide some serious classification problems. While the technology is common to all, and many of the occupational skills are shared, some electricity-electronics occupations are closely allied to construction (e.g., construction Electricians), and others show substantial similarities to mechanical occupations (e.g., Radio, TV, and Appliance Repairmen). The common knowledge components of all these occupations seem to override these considerations and warrant their designation as a separate occupational cluster.

Principal Occupations

Electricians

Electrical Repairmen

Electronic and Communications Technicians

Radio, TV, and Appliance Repairmen

Substation Operators

Linemen

F. Metal Working Cluster.--The function of metal working occupations is the shaping of metal parts such as gears, cylinders, heating ducts, auto bodies, etc., and the assembly of those parts into finished or semi-finished products. Many of these occupations involve the operation of machine tools at various skill levels, while others principally involve bench work.

Principal Occupations

Machine-shop Foremen
Machinists
Tool and Die Makers
Metal-working Machine Operators
Machine-shop Laborers
Metal Processing and Foundry Workers
Sheet Metal Workers
Welders
Saw Filers

G. Graphic Arts Cluster.--Printing and related preparation of graphic materials is traditionally identified as graphic arts, despite the appreciable differences in job duties and skills between the designers and the printing equipment operators.

Principal Occupations

Designers
Lay-out Men
Compositors and Typesetters
Photoengravers and Lithographers
Pressmen

H. Textile and Apparel Cluster.--The manufacture of fabrics and their conversion into finished apparel is an activity whose scale ranges from very large manufacturing plants to small shops. Textile and apparel manufacture is an activity with considerable regional specialization. Laundry and dry cleaning work is a related activity, with little regional specialization, which is also included here.

Principal Occupations

Textile Spinners

Laundry and Dry Cleaning Workers

Sewing Machine Operators

Upholsterers

Drapery Makers

Tailors and Seamstresses

There are several other production clusters, such as chemicals and other processing clusters, which can be identified, and they would be if sufficiently detailed national data were available for construction of the classification system. The particular production clusters defined in this system thus reflect something of a regional bias, but this is in no way a criticism of the classifying principle, for additional clusters can readily be added. The purpose here, of course, is simply to indicate the applicability of the "functional" classifying principle in handling various types of occupations, including production occupations.

IV. Distribution Functional Group

The distribution of goods to markets is an activity which, while related to production in a significant way, is clearly distinct from it.

This Distribution Functional Group includes all of the various transportation, warehousing, stock control, and sales occupations, which are involved in the transfer and physical movement of goods from producers to consumers.

This function is not always recognized in economic or employment analyses. Sometimes only a two-sided classification--production or service--is employed, but such a treatment misses the distinctly different function of distribution (and other) occupations.

A. Transportation Cluster.--One of the most obvious components of distribution is the transportation of goods, passengers, and personal property. This is the function of the transportation occupations. The major activity of the workers of the Transportation Cluster is the operation of transportation equipment, whether over long distances or short.

Principal Occupations

Bus and Taxi Drivers

Route Men

Truck Drivers

Caterpillar Operators

Crane Men

Pilots

Railroad Engineers and Firemen

Railroad Brakemen and Switchmen

Railroad Conductors

Railroad Laborers

Ship Captains

B. Stock Control Cluster.--Stock Control occupations contribute to the efficient distribution of goods by controlling the stocks and flows of manufactured goods. Principle activities include the handling of stocks of merchandise, the maintenance of inventory records, and arrangement for shipment and receipt of goods. Occupations in the Stock Control Cluster share some of the skills of Clerical and Bookkeeping-Accounting occupations, and many work in close physical proximity to workers in the Transportation Cluster, however, their function is distinct. Nearly all stock control jobs involve important elements of moving merchandise, but stock control also requires an orderly scheme for storing goods as well as adequate record keeping, since those are additional important functions of stock control occupations.

Principal Occupations

Shipping and Receiving Clerks

Industrial Truck Operators

Car Loaders

Dock Clerks

Warehousemen

Postal Clerks and Mail Carriers

Box Boys

C. Sales Cluster.--The final link in distribution is the marketing of goods and services to households and to industrial consumers. Sales personnel work in a variety of settings, but the function is always the same, the identification of consumer needs, and the persuading of potential customers in favor of a product or service. This is a common category of occupations which appears in nearly every classification system.

Principal Occupations

Sales Managers
Real Estate Salesmen
Automobile Salesmen
Advertising and Other Business Service Salesmen
General Salesmen
Insurance Salesmen
Sales Person
Manufacturers Representatives
Sales Clerks
Grocery Clerks

D. Food Service Cluster.--This is a cluster of occupations which perform the function of preparing and distributing food to customers in restaurants, cafeterias, and other eating and drinking places. There is considerable variation in the function of individual occupations within this cluster. For example, cooks and kitchen helpers are largely engaged in processing food in ways very much like food products workers. On the other hand, waitresses' duties involve personal service and selling. In spite of these similarities of individual food service occupations to occupations in other clusters, there is a distinctive function which is common to these occupations and which sets them apart. The overriding importance of this "food service" function as a basis for classifying these jobs is augmented by the common work setting and the high degree of occupation mobility among these particular occupations. These factors, together with the common practice of identifying food services as a category of occupations, seems to warrant the definition of this as a separate cluster.

Principal Occupations

Chefs and Dinner Cooks
Fry Cooks
Bartenders
Car Hops
Bakers
Kitchen Helpers
Waitresses
Bus Boys

V. Direct Service Functional Group

Service is one of the categories of activity which is clearest and which is traditionally recognized in analytical treatments of the economy. It is used here to identify occupations whose function is to provide services directly to people. In this group the labor itself is the principal component of the final product.

This is recognized as a rapidly growing functional area which includes health, social, and a variety of other services rendered directly to the consumer.

A. Health Services Cluster.--The occupations in this cluster provide a wide range of services relating to the health needs of individuals, including prevention, diagnosis, treatment, and rehabilitation. One essential feature of the occupations of this cluster is that they deal directly with patients. While the vast majority of workers in the health service occupations are involved with the treatment of human illness, there are occupations included here, including pharmacists, veterinarians, embalmers, and barbers, who provide somewhat different types of services relating to health. Nevertheless, the function remains much the same, but with somewhat greater emphasis on cosmetic considerations.

Principal Occupations

Dental Hygienists

Dieticians

Licensed Practical Nurses

Embalmers

Barbers

Pharmacists

Registered Nurses

Nurse Aides

Orderlies

Cosmetologists

Dispensing Opticians

Veterinarians

Principal Occupations--Continued

Physicians

Dentists

Veterinary Hospital Attendants

B. Social Services Cluster.--A complex society establishes special institutions to deal with the social needs of its members. Whereas the family once provided nearly all social services many are now performed by professionals operating in more formalized settings. One of the largest and most influential of those institutions is the educational system. The other traditional social services, the clergy, law, and social workers, specialize in other areas of man's social needs. A number of specialized areas including education, guidance, recreation, and corrections can be identified, however, there is a common area of concern, a similarity of worker requirements, as well as a relatively high degree of occupational mobility among workers in these occupations.

Considering the overwhelming dominance of education, in terms of size, it is worth examining whether education should not be treated separately. It can be argued that education sufficiently is distinct from say, guidance that the two should not be placed in the same cluster.

There can hardly be any doubt that both types of occupations fit into the broad categories of Direct Service, since both principally deal with individual people. The question is whether the function of education and the function of guidance are sufficiently similar to warrant their inclusion in a single cluster. Most classification systems such as Strong's classifications of interests tend to put them together, although Ann Roe defines two distinct foci: Service, which is primarily concerned with serving and attending to the personal needs and welfare of other people; and General Cultural, which is concerned with the preservation and transmission of the general cultural heritage (education, jurisprudence, ministry, etc.). This seems to be the kind of distinction which is being proposed.

While the classical emphasis in education may have been its role in preserving and transmitting the cultural heritage, I suspect that broad public education exists mostly because we believe children need help in preparing for their future lives. This "student centered" aspect of education is what appears so similar to counseling and guidance.

The principal basis for the decision about clusters, however, must be the similarity or dissimilarity of skills involved in the two types of jobs. The worker requirements for guidance and counseling as defined in the DOT are:

> An occupationally significant combination of: Sympathetic attitude toward the welfare of others; capacity to absorb training and apply knowledge to the solution of diverse problems; verbal facility to relate to people at all levels; organizational ability in order to plan and direct guidance programs; tact, poise, and general demeanor that tend to inspire confidence and esteem.[14]

The general content of this paragraph sounds very similar to the worker requirements for teachers:

> An occupationally significant combination of: Interest in people and ability to communicate ideas; intellectual capacity sufficient to acquire necessary background in subject matter area and in teaching techniques; organizational ability to present facts in answering students' questions and plan programs of instruction; and perception for clerical detail.[15]

The DOT also shows similar relationships of guidance and education occupations to data, people, and things. Guidance and counseling receives worker trait code 208 (analyzing data, mentoring people, and no significant relationship to things) (emphasis added), while most teaching positions receive a 228 code (analyzing data, instructing people, and no significant relationship to things) (emphasis added). As can be seen, this analysis from the DOT indicates that the only significant difference between guidance and education is a higher order relationship to people required for counseling than for teaching. An additional consideration is the practical problem of distinguishing between education and guidance, which is often rather great, as in the case of special education teachers, kindergarten teachers, school social workers, etc.

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[14] U.S. Department of Labor, Dictionary of Occupational Titles, 3rd Ed., Vol. II, p. 296.

[15] Ibid., p. 341.

With regard to the work environment, no firm conclusion can be drawn. Most, but not all, teachers work in schools but so do a large portion of counselors and some caseworkers. Other counselors work in separate social agencies, but even they often deal with students and school personnel. The new models for the delivery of social services, e.g., community action agencies, community colleges, and neighborhood service centers, tend to include both education and guidance, suggesting that such a combination may be the most useful way of viewing these jobs.

Principal Occupations

- Educational Administrators
- Elementary and Secondary Teachers
- Music Directors
- University and College Teachers
- Teacher Aides
- Counselors

Principal Occupations--Continued

Clergymen
Caseworkers
Psychologists
Lawyers
Employment Interviewers
Recreation Attendants
Housemothers
Juvenile Counselors

C. Protective Services Cluster.--The protective service occupations are responsible for safe-guarding all types of property, and for the safety of people as established by public laws. Protective service occupations are of three types: Policemen, firemen, and watchmen. While the duties of these occupations have become fairly specialized because of rapidly changing technology and increasing needs for protection, the basic function of protection remains common to all. The largest number of employees in protective service occupations are in state and local government, but that is not the distinguishing characteristic of this cluster, for there are private counterparts of public police and fire agencies, and the vast majority of guards and watchmen are employed in a private sector.

Principal Occupations

Police Officers

Firemen

Guards

Watchmen

Some Conceptual Advantages of a Functional Classification of Occupations

It is readily apparent that the system just described is a rather highly integrated one with relationships of product flow, market, and, sometimes, working place, serving along with job duties to reveal the functional relationships of occupations, both between groups and within them. The functional relationships of occupations are portrayed in Figure 3. The smaller elipses represent clusters of occupations. The clusters are grouped according to their broad functional groups, of which there are five. Strong relationships of work flow between clusters are indicated by continuous lines; weaker but significant relationships are indicated by broken lines. The functions identified are quite distinct and, as will be seen later, these distinctions are reflected in a substantial number of other intra-group similarities. Before discussing the operational and analytical utility of the system, there are a number of noteworthy conceptual advantages to the Functional Classification of Occupations which should be noted.

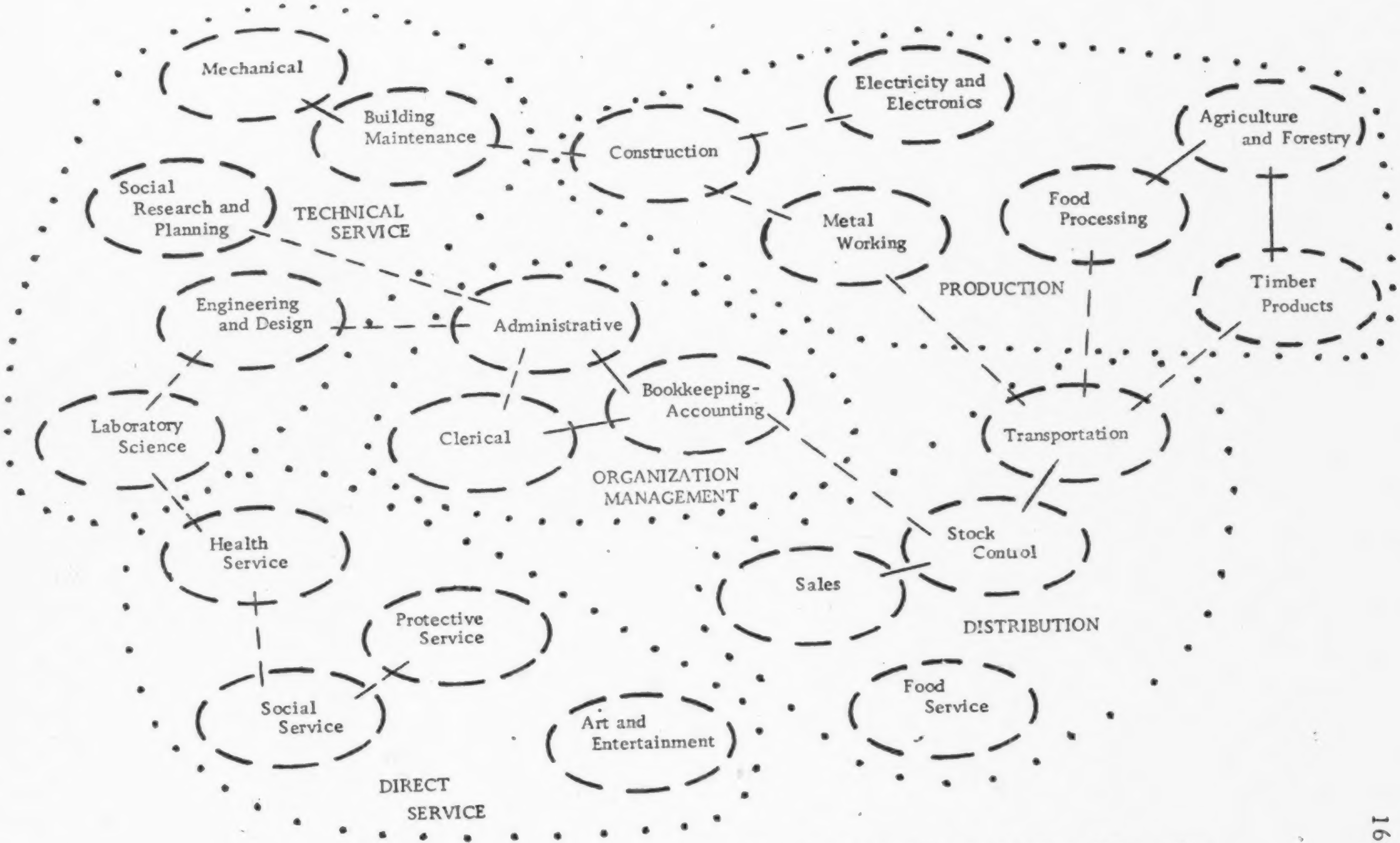
Mechanical
Building Maintenance
Social Research and Planning
TECHNICAL SERVICE
Engineering and Design
Laboratory Science
Construction
Electricity and Electronics
Metal Working
Food Processing
Agriculture and Forestry
Timber Products
PRODUCTION
Administrative
Bookkeeping-Accounting
Clerical
ORGANIZATION MANAGEMENT
Transportation
Stock Control
Sales
DISTRIBUTION
Food Service
Health Service
Protective Service
Social Service
Art and Entertainment
DIRECT SERVICE

Fig. 3.--A mapping of occupational clusters and functional groups in a Functional Classification of Occupations

Two of the major conceptual advantages of the Functional Classification of Occupations have already been discussed, but they bear repeating here. One of the chief advantages of this system is that it is based on a general principle, that of social or economic "function," which is highly relevant to all occupations, and the principle is one which is readily definable and easily understood. The second major advantage already notes is that this system, while incorporating a new classification variable, uses the existing job duties basis for defining occupations and is, thus, perfectly compatible with existing occupational definitions. The system is strictly a classification system; it is not a definitional system. Therefore, existing detailed occupational definitions on occupational data can be reorganized into the Functional Classification system without re-defining the basic occupational units or generating totally new data for detailed occupations.

Another advantage of the Functional Classification of Occupations is that it handles certain marginal cases quite readily. By comparison with biological and other physical phenomena social characteristics are extremely hard to classify, and any classification of social phenomena, it must be constantly remembered, is an imposition by the classifier. The world of social phenomena is a world characterized by gradual transitions from one characteristic to another, not by abrupt changes. This is true with regard to occupations as with other social phenomena. Thus it is that specific jobs and specific occupations do not fall neatly into job families of any type.

It is argued here that occupations fall more readily into functional categories than into many other types of categories, but there are still occupations which do not fit neatly into one group or another. The occupations posing the most perplexing problems for this system are those which seem rationally to fall into more than one cluster, and those which seem unlikely members of any cluster. Certain problems of the former type have already been discussed in describing the various job clusters. Hybridized occupations, such as education administrators, clearly pose problems for a function-based classification system. Occupations such as cat skinners, which are integrally related to the two clusters of Construction and Timber Products, pose additional problems, as do laboratory technicians, many of whom are closely related to production processes, while others are involved most extensively with medical services. Occupations are in some ways like stars in the night sky where certain constellations and other groupings are discernible, but there are still individuals which do not fit the overall pattern. Any classification system will have its ambiguities. This problem is handled in the clustering of occupations by assigning the occupations on the basis of their major functions, and that practice seems to leave fewer ambiguous cases than other occupational classification systems.

The second type of occupation which poses problems are those which do not seem to fit into any of the broad functional groups. These include subsistence occupations, each of which usually incorporates a wide variety of types of activities, and certain creative occupations whose economic components are minimal. These creative occupations do not fit well into the system because they seem not to be integrated in any very significant way into the economic system. Certain artists, pure researchers, explorers, and others are of this sort. While they are supported financially, and therefore must serve some function in the eye of the employer, the economic component of their work is so distinctly secondary to their creative role that they can hardly be said to fit into any of the five broad functional groups. They might almost be said to constitute a sixth, "Creativity," functional group, whose function is not problem solving as in the technical service group, but simply discovering, expressing, or interpreting, with no further purpose in mind. Whatever their function and whatever their long-run significance to culture, technology, or society, their numbers are miniscule in comparison with the major clusters described above, so that their classification proves to be of no statistical significance, whatever it may be. It is probably best to group them loosely in a creativity group, so that the classification system will not appear to absorb them in a way which denies their quasi-independence and strains the conceptualization of the functional group or cluster in which they are placed.

While there are a number of occupations which are difficult to classify on a functional basis, the number of such occupations is much smaller and the solutions are much more apparent in the case of a functional classification system than is the case of many other classification systems, largely because the functional classification makes no attempt to achieve a consistent, uni-dimensional ranking of all occupations.

A fourth advantage of the functional classification system is that it is flexible with regard to level detail. Not only are there three levels of detail in the classification system (four, if occupational specialities are counted), but in this system occupations can be partially classified when there is insufficient data to permit a full classification, or when dealing with obscure positions which do not warrant separate occupational designation. While this feature is also characteristic of some other occupational classification systems, the analytical usefulness of partially classified data is probably greater in this system than in most others. This flexibility is a particularly desirable trait when dealing with empirical data derived from a variety of sources of inconsistent precision.

This system reflects a new classifying principle, and is thus distinct from the traditional, socio-economic systems. It provides a substantial amount of comparability with those older systems on which basis most historical data are classified, and that is a desirable feature. The basic distinction between production and non-production workers is maintained, and in fact is clarified by the consideration of the five functional areas. The socio-economic sales group has its counterpart in the functional Sales Cluster, while the socio-economic clerical group appears in the Clerical and Bookkeeping-Accounting Clusters in the functional system. Managerial occupations in the socio-economic system have their rough counterpart in the Administrative Cluster. Thus while there are certainly problems of comparability between the functional system and the older socio-economic systems, there is a certain amount of consistency between the two as well.

CHAPTER V

SOURCES OF OCCUPATIONAL DATA AND THE OPERATIONAL ADVANTAGES OF A FUNCTIONAL CLASSIFICATION OF OCCUPATIONS

The operational advantages of a Functional Classification of Occupations becomes apparent as one examines the sources of and methods for compiling occupational data. There are essentially two basic sources of occupational data: households and employing establishments. As was noted earlier, both are used in the United States. Households are the source of data, including occupational employment data, for the decennial census and for the monthly Current Population Survey from which the Monthly Report of the Labor Force is compiled. Establishments are the source of the vast majority of detailed data regarding industries, and they are the source of various types of occupational data, including State Employment Security Agencies' "Area Skill Surveys," the staffing pattern studies conducted by the Occupational Field Centers of the U.S. Training and Employment Service, and, increasingly, various special studies conducted by the U.S. Bureau of Labor Statistics.

Unfortunately none of these has yet developed into a continuing program to collect and publish employer-based occupational data. Unlike industry data, neither household nor establishment occupational data are available as a by-product of established taxing or service programs. Consequently occupational data become available only as a result of special original research efforts of one type or another

The only broad-based, continuing data generating programs have been household surveys: the Population Census, which yields data only once in ten years, and the Current Population Survey which, though conducted monthly, yields only national data in broad occupational categories. Recently, however, the Bureau of Labor Statistics has taken some tentative steps toward continuous occupational data collection from establishments by testing in ten pilot states an "Occupational Employment Statistics Program" whereby a sample of employing establishments report occupational employment on a regular basis.

Why the trend toward establishment based occupational employment data? There are several important reasons, the principal one probably being the unreliability of household data, at least as it is collected and processed in the decennial Census of Population, which depends on an unreliable source and succumbs to numerous classification errors. The accuracy problems of the Census are discussed in the following sections.

Inadequacies in Census Occupational Data

Short of conducting expensive area household surveys, the major alternative to the employer survey as a way of making occupational projections is to use Census data. It is therefore desirable that these data be evaluated. The Bureau of the Census has conducted evaluation studies of both the 1950 and 1960 Censuses. The 1960 follow-up study is known as the Evaluation and Research Program of the U.S. Censuses of Population and Housing (Series ER60). The 1950 study is called The Post Enumeration Survey: 1950 (Technical Paper No. 4). Though these follow-up studies themselves have come under some criticism,[1] the generally superior methodology and greater technical expertise used in these evaluation studies seem to justify the use of these data as valid benchmarks for evaluation of regular Census data.

In the following evaluation of Census data, both evaluation studies are used, although the differences in their methodologies determine the issues on which each can be appropriately used. While the 1950 Post Enumeration Survey (P. E. S.) basically uplicated the Census approach of visiting households, the 1960 tudy, commonly referred to as the "Employer Record Check" E.R.C.), matched occupations as reported by households with occupations as reported by their employers, for a sample of employees reported in the Census. Though this latter method has several advantages over the household survey approach as a way of developing occupational statistics (including cost and convenience), the methodology used in the 1950 follow-up serves to test the major shortcomings of the Census data collection and coding while keeping constant the basic approach--thereby rendering the P.E.S. a better criterion for evaluating the interview error of Census data.

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[1] J.G. Scoville, "Making Occupational Statistics More Relevant," 1965 Proceedings of the Business and Economic Statistics Section of the American Statistical Association, p. 318.

These two studies reveal various kinds of inaccuracies in ensus reporting (such as a probable under-reporting of some ree and one-half million persons), but the most relevant type of rror for purposes of occupational analysis is the misclassification occupation and industry.[2]

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[2] According to Leslie Fishman, et. al., Methodology for ojection of Occupational Trends in the Denver Standard

By examining Table 3 it can be seen that the net error in the sus for the 11 broad occupational classifications is only 2.16 rcent, according to the P.E.S. In the net figures, we note that e reporting accuracy ranges from the .06 percent error for fessional, technical, and kindred to no worse than 7.67 percent rror in reporting private household workers. However, before sing any detailed occupational analysis on these data, it is propriate to examine the extent of the "equalization of errors." e deceptive accuracy of these net figures comes about because gross over-statement (8,239,000 for all classifications) largely lances the gross understatement (9,438,000 for all classifications). better measure of error is achieved when the gross error in er-reporting is added to the gross error in under-reporting for occupational classifications. This yields a total of 17,677,000 ss errors in the Census out of the Census Labor Force of 07,000. (See Table 4.) In other words, of all occupational ssifications made by the 1950 Census, 31.8 percent were neous.[3]

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ropolitan Statistical Area, Bureau of Economic Research, tute of Behavioral Science (Boulder, Colorado: University of rado, March, 1966), p. 11.

[3] Bureau of the Census, U.S. Department of Commerce, *The Enumeration Survey: 1950*, Technical Paper No. 4, p. 35.

TABLE 3

NET ERRORS IN THE 1950 CENSUS ACCORDING TO THE P. E. S. (in Thousands of Persons)

Census Occupation lassification	Census Total Employed	Net Over (+) or Under (-) Statement in the Census	Net Over or Under Statement as a Percent of Census Total
S. TOTAL	55,507	-1,199	-2.16%
Professional, Technical, and Kindred	4,910	+ 3	+ .06
armers and Farm Managers	4,309	- 53	-1.23
Managers, Officials, and Proprietors	5,018	- 313	-6.24
Clerical and Kindred Workers	6,895	- 168	-2.44
ales Workers	3,927	+ 19	+ .48
Craftsmen, Foremen, and Kindred Workers	7,783	- 285	-3.66
peratives and Kindred Workers	11,140	- 242	-2.17
rivate Household Workers	1,408	- 108	-7.67
ervice Workers	4,286	- 120	-2.80
Farm Laborers	2,400	+ 126	+5.25
Laborers Except Farm and Mine	3,431	- 58	-1.69

urce: Adapted from The Post Enumeration Survey: 1950, p. 35.

TABLE 4

GROSS ERRORS IN THE 1950 CENSUS
ACCORDING TO THE P. E. S.
(in Thousands of Persons)

Census ccupation ssification	Census Total Employed	Total Gross Errors in the Census	Total Gross Errors as a Percent of the Census Total
S. TOTAL	55,507	17,677	31.8%
rofessional, Technical and Kindred	4,910	999	20.3
armers and arm Managers	4,309	821	19.1
anagers, Officials and Proprietors	5,018	2,197	43.8
erical and Kindred Workers	6,895	1,654	24.0
les Workers	3,927	1,309	33.3
raftsmen, Foremen, nd Kindred Workers	7,783	2,645	34.0
eratives and indred Workers	11,140	3,574	32.1
ivate Household orkers	1,408	284	20.2
rvice Workers	4,286	962	22.4
rm Laborers	2,400	1,162	48.4
borers Except arm and Mine	3.431	2,070	60.3

rce: Adapted from *The Post Enumeration Survey: 1950*, p. 35.

Without devoting detailed analysis to the Census reporting of ustrial groups it appears that the percentage of errors here is a slightly lower level than is the case with occupational groups. e number of misclassification errors in industry is cited by the E.S. as 14,030,000 or 25.3 percent of the total labor force, mpared to the 31.8 percent for misclassification of occupations.

While the 1960 Employer Record Check is not strictly omparable to the resurvey of households conducted in the P.E.S., e results are similar. The similarity can be observed in Table 5, here the classifications identically reported in the Census and e P.E.S. and E.R.C. are expressed as a percent of each study's cupational totals. As the table shows, the two methods yield airly similar results, except in the classifications of "managers, ficials, and proprietors," and "laborers except farm and mine." these cases, the relatively great inaccuracies which appeared the 1950 Census were accentuated by the E.R.C. method used evaluate the 1960 Census.

Unfortunately, neither follow-up study evaluates the accuracy data for specific occupations. However, Harry Greenspan ports attempts to evaluate Census reporting on detailed cupations by comparing the national employment reported in occupations in the 1960 Census with various other sources

TABLE 5

COMPARISON OF THE PERCENT IN E. R. C. AND P. E. S. CLASSIFICATIONS IDENTICALLY REPORTED

Census Occupation lassification*	1950	1960
rofessional, Technical and Kindred	89%	89%
Managers, Officials, and Proprietors	76	57
Clerical and Kindred Workers	87	83
ales Workers	82	89
raftsmen, Foremen and Kindred	81	89
peratives and Kindred	82	84
ervice Workers Except Private Household	86	84
aborers Except Farm and Mine	66	50

urce: Leslie Fishman, et. al., Methodology for Projecting Occupational Trends, adapted from pp. 13-21.

*Three of the 11 broad occupational categories used in the ensus were not included in the E. R. C.

onsidered to be valid criteria for evaluating the Census data.[4]

hese comparisons appear in Table 6.

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[4] Harry Greenspan, "Estimates of Employment Requirements Occupation for Future Periods--Data Sources and Model Development," Long-Term Manpower Projections, edited by R. A. Gordon erkeley, California: University of California, Institute of dustrial Relations, 1965), pp. 44-58.

EMPLOYMENT ESTIMATES FOR SELECTED OCCUPATIONS, CENSUS AND OTHER SOURCES, 1960

Occupation	Employment (in thousands) 1960 Census	Other Source	Census as a % of Other Source	Description of Other Sources
Engineers*	681	649	105	B. L. S. Survey of Employment of Scientific and Technical Personnel in industry
Chemists*	67	77	87	
Draftsmen*	186	210	89	
Dentists	83	87	95	Licensure statistics
Professional Nurse	582	504	115	Joint estimate of the Inter-Agency Conference on Nursing, and statistics-based on a variety of data
Student Nurse	57	115	50	Enrollment statistics
Pharmist	92	117	79	Census of N. A. B. P. members and licensure data
Physician	229	225	102	Membership records of A. M. A. , adjusted
Veterinarian	15	20	75	Membership of A. V. M. A. plus known nonmembers, less retired
Telephone Operators**	220	218	101	Data submitted to the Federal Communications Commission
Postmaster	36	35	103	
Postal Clerk and Supervisor	212	258	82	Post Office payroll records
Mail Carrier	196	204	96	

Source: Harry Greenspan, "Estimates of Employment Requirements by Occupation for Future Periods--Data Sources and Model Development," Long-Term Manpower Projections, edited by R. A. Gordon (Berkeley, California: University of California Institute of Industrial Relations, 1965), p. 54.

*Includes private wage and salary workers outside of colleges and universities and non-profit organizations.

**Telephone industry only.

Although the reporting in some occupations, such as the ssification of "student nurse," showed the Census to be clearly ccurate, most of the 13 titles indicate a fair degree of accuracy. wever, based on our experience with larger numbers and oader categories, we must assume that much of this apparent curacy is deceptive. In the broad categories, much of the pparent accuracy was due to a balancing of errors in over- eporting and errors in under-reporting. Although it cannot be easured, there is no reason to believe that this balancing of rrors does not prevail at more detailed occupational levels as ell. If this is the case, we may choose to simply ignore these nternal" inconsistencies and concentrate on the data totals, in e hope that these figures are functionally close to being ccurate. However, this is risky at best, for at such levels of etail there is no way of knowing when this balance will break wn, as may have been the case in the highly inaccurate reporting f student nurse.

Using statistical methods of principal component analysis, innick found that from 7 to 14 percent of the persons classified y the Census in selected technical occupations reported job activity atterns that deviated so greatly from the group mean that they ould not properly be classified in the same occupation. These results indicate that there is a great deal of heterogeneity within specific Census occupations as well as among occupations in a broad occupational group. These results are even more noteworthy considering the fact that multivariate analysis had already eliminated 13 percent of the cases from the various groups as being unreliably classified.[5]

We shall not attempt a detailed assessment of the reasons for the erroneous classifications here; although the source of the data must be largely responsible. The Gordon Committee speaks of the

> . . . difficulty of obtaining accurate information from the housewife or other family respondents to questions about the occupations of all employed household members. The reply is often ambiguous or incomplete; frequently the worker himself does not know the proper title for his occupation.[6]

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[5] Andrew J. Winnick, "A Methodology for the Evaluation and Correction of Unreliability and Excessive Heterogeneity in Occupation Classifications." Paper presented to the Western Economic Association Convention at the University of California at Davis, August 28-29, 1970. (Mimeographed.)

[6] The President's Committee to Appraise Employment and Unemployment Statistics, R.A. Gordon, Chairman, Measuring Employment and Unemployment (Washington, D.C.: U.S. Government Printing Office, 1962), p. 203.

Another serious problem for evaluation is the large percentage of persons who are listed under the "Not Elsewhere Classified" category in the Census classification system. For each of the occupational categories in the Census, a large portion of the employment appears in very broad groups or is labeled as being in the residual sub-group of Not Elsewhere Classified (N. E. C.). Examination of the "Percent Classified as Not Elsewhere Classified" column in Table 7 reveals the relative size of this component in each occupational category. These give an indication of how conducive the specific occupations of each category are to accurate classification, as well as how difficult it is to get detailed occupational data from the Census. In a category such as Professional, Technical, and Kindred, the occupations are relatively well defined, and the low percentage (14. 2 percent) is to be expected. In less precise categories like managers, and laborers, however, the percent classified N. E. C. rises to a very high level.

It can readily be seen from Table 7 that the percent N. E. C. varies greatly from occupational group to occupational group. It should also be noted that the exact figures will vary depending upon which categories are considered to be N. E. C. and which are not. In attempting to identify those categories which are not useful at the detailed level, there would undoubtedly not be complete

TABLE 7

PERCENT OF EMPLOYMENT CLASSIFIED N. E. C. IN THE 1960 CENSUS

Census Occupation Classification	Percent N. E. C.
Total , All Occupations	38. 6
Professional, Technical, and Kindred	14. 2
Farmers and Farm Managers	0
Managers, Officials, and Proprietors	89. 2
Clerical and Kindred Workers	33. 1
Sales Workers	80. 7
Craftsmen, Foremen, and Kindred	29. 4
Operatives and Kindred	45. 1
Private Household Workers	70. 2
Service Workers Except Private Households	10. 1
Farm Laborers and Foremen	0
Laborers Except Farm and Mine	81. 5

Source: Compiled from U. S. Department of Commerce, Bureau of the Census, 1960 Census of Population, Vol. I, Characteristics of the Population, Part I, U.S. Summary, Table 202, pp. 1-528 (Washington, D. C.: U.S. Government Printing Office, 1964).

agreement on the handling of such categories as "Self-Employed Managers, Officials, and Proprietors," "Miscellaneous Natural Scientists," etc. Thus different observers would produce somewhat different figures in a table such as Table 7.[7] However, specific cases may be handled, any percentages approaching the 39 percent shown in Table 7 are too large, and the classification system loses its utility for most detailed analyses.

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[7] For instance Scoville in "Making Occupational Statistics More Relevant" finds the national percent N. E. C. to be 34. 4 percent compared to the 38. 6 percent appearing in this analysis.

It appears that the same problem exists in state and area Census data. An analysis of occupational employment classified N.E.C. corresponding to that of Table 7 yields the following results for the State of Oregon and for the Eugene, Oregon Standard Metropolitan Statistical Area.

Area	Percent N.E.C.
U.S.	38.6%
Oregon	37.7
Eugene S.M.S.A.	41.2

Percents of employment classified N.E.C. for individual occupational groups in these smaller areas correspond generally to the percentages for the nation shown in Table 7. Thus there is little reason to believe that the Census classification is any more exhaustive for small areas than for the nation as a whole.

In summarizing this evaluation of occupational classification in the U.S. Census, one figure stands out--one-third of the labor force is erroneously classified. While evaluation measurement at local levels and in more detailed classifications is difficult with presently available data, we can assume that hazards which exist at the national level are multiplied when the area shrinks to a state or county or when occupational categories become sufficiently detailed to be of practical use. Harry Greenspan, in Long-Term Manpower Projections, warns that "Any errors in the broad group estimates in the Census are averages of errors for the detailed occupations in the group, and a broad group estimate in the Census which appears reasonable in total may result from offsetting errors for individual occupations."[8]

Census data are of limited use for yet another reason. With regard to the Census, the Gordon Committee concludes:

> Although the census is an invaluable source of demographic information and very useful for appraising historical trends, its applicability to many current problems is limited by the fact that it is taken only once a decade and estimates are not available until about two years later. The figures are 12 years old before the next set of census data becomes available.[9]

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[8] Greenspan, "Estimates of Employment Requirements by Occupation for Future Periods--Data Sources and Model Development," p. 52.

[9] President's Committee to Appraise Employment and Unemployment Statistics, Measuring Employment and Unemployment, p. 202.

Criticisms of the Census occupational data can be summarized as follows. The occupational classification system used to group Census data relegates a large portion of employment to N.E.C. and like categories whose content is obscure, and whose utility for detailed occupational analyses is practically non-existent. Moreover, even this unsatisfactory system is not capable of satisfactory application to data collected from households, so that as many as a third of the cases are erroneously classified. Add to these ambiguities the fact that the most current data are anywhere from two to twelve years old, and it becomes apparent that Census occupational data are not a very satisfactory foundation for analyses of area occupational employment.

The errors and problems of classification and comparability to other data have convinced Leslie Fishman of the University of Colorado that Census data are of little use for any but the most general purposes where occupational data are concerned.

> At present the major categories give sufficient detail to be useful, but the P.E.S. and E.R.C. studies showed that even present detail is not supportable by the data.[10]

It is of course hard to judge how much of the error in Census data is attributable to households as a source of data, how much to the difficulties of administering an entire population census in a country such as the United States, and how much to an awkward classification system of limited capacity and analytical usefulness. Whatever their relative weights, surely all three are contributing factors which, in combinations, lead to data of very limited usefulness. While the interest of this analysis is the classification system, it is relevant to know that the employer survey overcomes some of the problems inherent in the Census size and reliance on household data.

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[10] Fishman, et. al., Methodology for Projection of Occupational Trends in the Denver Standard Metropolitan Statistical Area, p. 45.

Though basing their occupational data on Census data, the Bureau of Labor Statistics attempts to circumvent some of these problems by incorporating other, better sources of information when available. The following description appears in Tomorrow's Manpower Needs:

> The main source of detailed and complete information for the national matrix for 1960 was the U.S. Census Bureau's Occupation by Industry report based on the 1960 census. The BLS occupation by industry matrix, however, differs from the census report in two major ways: (1) The BLS matrix was made consistent with other sources of data; and (2) the BLS table makes use of occupational data from a number of sources considered preferable to decennial census data. It was desirable to make the matrix consistent with broad industry and occupational group employment estimates available from the monthly household survey (CPS) so that full advantage could be taken of data available between

decennial census years. The following occupational data were used in BLS matrix in addition to the broad occupational group estimates from the CPS: Employment of scientists and engineers by industry based on BLS surveys of employers; employment of teachers and librarians based on data collected by the Office of Education; employment by occupation data collected by regulatory agencies for inter-state industries including railroads, airlines, telephone and telegraph communications, and pipelines; employment data collected by professional societies, especially for medical and health occupations; selected data from BLS industry and community wage surveys, information from the Post Office Department on employment by occupation in the Post Office; and Federal Civil Service Commission statistics on employment by occupation in other Federal Government agencies.

The projection of the occupational structure of each industry was based on examination of historical statistics and evaluation of other factors that might influence occupational structure, such as expected new technology, changes in the product mix and general organization of industries.[11]

Employer Surveys as a Source of Occupational Data

The alternative to the present Census procedure of interviewing households consists of obtaining occupational information from employers. By so doing, the more serious shortcomings of the Census approach can be largely avoided. There would be far less ambiguity in reporting job titles and accurate classification would be greatly facilitated. Fishman, et. al., describe as an "ideal" source of occupational information "standardized employer data on a current, continuing basis, but analyzed by occupation, industry and region on an overall basis by economic and business experts."[12]

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[11] U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. IV (Washington: U.S. Government Printing Office, February, 1969), p. 9.

There are several other reasons for preferring establishment to household data, however. For one thing, firms are a more economical population to survey than households. Listings and addresses, as well as certain other significant characteristics of all population members are continuously available from several sources. In addition, a single contact can yield information about a large number of employees rather than just one or two as in a household. Moreover, firms are a more reliable source of job duty, hiring requirements, wage, and related occupational data. They may, though there is debate on this point, provide a source of useable forecasts which households clearly cannot. Their existing identification as to industry and size makes correlation of occupational and industry data an easy matter, and it makes possible various types of occupationally relevant stratifications of the population for survey purposes which is not feasible with households.

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[12] Fishman, et. al., Methodology for Projection of Occupational Trends in the Denver Standard Metropolitan Statistical Area, p. 25.

As a final judgment, however, it must be said that the Census provides the only methodology for measuring certain classes of occupations such as self-employed, unpaid family and domestic workers. Thus the Gordon Committee concludes that a program of current occupational employment statistics will require data from a variety of sources. The foundation of such a system would be periodic employer surveys. Information from the employer survey would be supplemented by household surveys for information about occupations where self-employment is substantial and by the analysis of other records such as the existing survey of scientists, engineers, and technicians where such information is available.[13] In any case, the Gordon Committee concludes, "Information obtained should be immediately useful for administrative purposes in connection with worker training and for vocational guidance."[14] The techniques of interviewing and classifying which are currently used in the Census have been proven insensitive to the measurement of detailed occupations, and the timeliness of the data is seriously limited. For purposes of studying detailed occupations, especially at the local level, it would be advisable to make maximum use of employer data, supplementing it with Census data where necessary.

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[13] President's Committee to Appraise Employment and Unemployment Statistics, Measuring Employment and Unemployment, pp. 203-04.

[14] *Ibid.*, p. 204.

This is not to say that establishment-based data are without problems. Employer forecasts have been subject to particular criticism on *a priori* grounds[15] and as a result of some empirical evaluation of the inaccuracy of seasonal forecasts.[16]

Forecasts of occupational employment based on employer forecasts are not as inadequate as this literature suggests,[17] but that is not the issue here. The subject at hand is the validity of employer reporting of current occupational employment, not their forecasting abilities.

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[15] See for instance, Sol Swerdlof, "Industry Employment Projections," *Long-Term Manpower Projections*, pp. 16-17.

[16] See Douglas G. Hartle, *The Employment Forecast Survey* (n.p.: University of Toronto Press, 1962); Employment Security Commission of North Carolina, *Employer Forecasts of Future Labor Requirements* (Raleigh: Employment Security Commission of North Carolina, 1958); Robert Ferber, *Employers' Forecasts of Manpower Requirements: A Case Study* (Urbana: University of Illinois, 1958).

[17] Bruce McKinlay, "Some Observations on Employer Surveys," a paper presented to the Conference on Long-Range Occupational Projections, November 1-3, 1961, Bureau of Employment Security, Washington, D. C.

Problems in the conduct of employer surveys are related mostly to employer record keeping and job classification practices. It is sometimes difficult to isolate records for employees in the particular labor market area being surveyed when a firm has centralized personnel records for a geographically diverse operation. Employer job titles pose another set of problems, since titles for the same job vary from firm to firm and different jobs sometimes go by the same title.

There remains much debate about the preferred sources of occupational data, and even Census critic James Scoville has reservations about the accuracy of employer reports.[18]

Be that as it may, there is growing opinion that establishments have significant advantages over households as sources of occupational employment data. This trend toward development of establishment based occupational data is significant here, because the Functional Classification of Occupations has some very substantial operational advantages when an establishment based data generation system is being used.

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[18] James G. Scoville, "Discussion," in Robert C. Young, ed., Manpower Information for Vocational Education Planning (Columbus, Ohio: The Ohio State University's Center for Vocational and Technical Education), p. 70.

One of the important operational advantages of the Functional Classification of Occupations is its ease of application. This is an advantage of the Functional Classification of Occupations which can probably be realized in a household survey but which is especially applicable to establishment surveys. Whereas it is argued that the Census socio-economic occupational classification system is especially suited for household surveys and the Dictionary of Occupational Titles for classifying employer occupational information, neither is a very easy system to use. It has already been seen that the Census system as used in the decennial census yields a 30 percent error. The DOT also poses a good many operational problems when used to classify employer reports of occupational employment. Unfortunately the literature contains no evaluations of the validity of employer surveys as sources of current occupational data or the difficulties encountered in use of the DOT. One evaluation of the occupational coding of a multi-industry employer survey conducted in a small metropolitan area gives some idea of the magnitude of coding error, and it can be compared to the results of a survey using a version of the Functional Classification of Occupations. Both evaluations are reported here.

Use of the DOT in an Area Skill Survey

The multi-industry employer survey in question is the 1967 Lane County Labor Skill Survey conducted by the State of Oregon Department of Employment in the Eugene, Oregon Standard Metropolitan Statistical Area. Some 1,400 employers in this labor market of 80,000 were asked, among other things, to "Please list each of the occupations on your payroll . . . . List trainee positions and any occupations you expect to add in the next three years. Be as specific as you can." The resulting lists of job titles, supplemented with personal characteristics of workers employed and with wage rates were then coded using the 6-digit DOT classification system.

The collection and processing of data for the Eugene study followed the conventional procedure for area Skill Surveys. Temporary Employment Service Interviewer Aides were hired to conduct the field interviews, edit and code mailed-in questionnaires, and follow-up non-respondents. With regard to occupational coding, all of the aides received three days of instruction on the use of the third edition DOT from an Occupational Analyst with the Department of Employment technical staff. To the extent feasible, interviewers were assigned particular industries, so that they could develop some familiarity with the occupations in those industries. The interviewers reviewed and coded their own questionnaires; however, they were instructed to seek help whenever they had trouble coding an occupation. Occupational Analysts were available part time to assist the interviewers with difficult cases and to review samples of their work. As a general rule, the questionnaires were processed without further review of the DOT codes.

This original coding was subsequently reviewed by labor market analysts who were generally familiar with the firms in the area and proficient with the DOT. Re-contacts with reporting firms were made in many, though by no means all cases where information was insufficient to permit coding. This review revealed an error in coding approaching 15 percent. It should be noted here that there is no reason to believe that the error in this study is any greater than the error in other studies conducted in the same manner. It is also important to recognize in comparing this 15 percent error with the 32 percent error found in the 1960 Census that the 15 percent reflects only coding errors whereas the 32 percent Census figure includes both coding and response errors. How close truly comparable figures would be is open to speculation.

Aside from problems involving the questionnaires and the interviewers, some of the problems with coding must be attributed to the extremely complex nature of the *DOT* coding system. The review done in Eugene identified a number of such problems which are worth reporting because they reflect structural difficulties in the *DOT*.[19]

1. *The difficulty involved in moving between Volumes I and II of the DOT*. This difficulty is most apparent when one attempts to review existing codes on questionnaires. For purposes of review, Volume II, the occupational group arrangement of job titles, is used first; however, when it is necessary to read the job descriptions contained in Volume I, the alphabetical arrangement of job descriptions, it is sometimes hard to find the desired information. There is a problem in understanding the alphabetizing of certain occupations. Managers, for instance, are sometimes classified under that term, and at other times they are presented under specific industry title.

2. *Heterogeneous six-digit groups*. One of the problems with the use of the *DOT* is the variety of jobs with the same six-digit code. It is common to designate technical and professional occupational groups separately, since the length of training is quite different between the two. However, their separation is impossible, since the *DOT* lumps these occupational groups together, in many cases at the six-digit level. For example, in one case Aeronautical Engineer and Engineering Draftsmen are given the same six-digit code (002.081). This problem, of course, has already been recognized and an additional three-digit supplement (bringing the total to nine digits) has been developed.

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[19] The following material is taken from an Oregon Department of Employment memorandum prepared jointly by the author, Lowell E. Johnson and Michael Shadbolt.

3. *Inconsistency in coding persons who teach*. The *DOT* seems to be inconsistent in its treatment of certain teachers. High school music teachers, for instance, are coded under the category 152. "Occupations in Music." By contrast, speech teachers are classified in "Occupations in Secondary School Education," category 091.

4. *Treatment of trainees*. In the *DOT* most, but not all, trainee occupations have the same six-digit codes as the journeymen, making them indistiguishable when only the *DOT* code is known. To handle this problem, operating personnel are instructed to substitute an "X" for the period after the third digit of the code. To follow this procedure in tabulating data would require an additional card column and special instructions to the coders. Without such special procedures the identification of trainees by code is impossible.

5. *Nearly identical occupations classified in two or more classes*. In searching for an appropriate *DOT* classification for a particular occupation, a coder may find several specialties of a particular occupation in different six-digit groups. For instance, different types of construction workers are distinguished at the sixth digit. Construction Worker I is coded 869.884 while Construction Worker II is coded 869.887. Because the job descriptions are so similar, there is a strong possibility of the same job being coded different places by different coders (or by the same coder at different times). The third edition *DOT* presents problems for grouping such occupational data, however, because like-occupations frequently do not fall next to each other in the six-digit system, since the differences are often defined in the third digit. The extremely fine distinctions between some codes presents problems in both coding and interpretation of the skill survey data.

6. *Interpretation of the DOT classification system*. The consistent classification of certain jobs, such as the various office occupations, certain managers, foremen, and supervisors, and other somewhat ambiguous occupations requires considerable interpretation on the part of the coder.

Since the occupational title often does not adequately describe the functional duties of a job, different codes will be given to the same job depending on the approach to coding taken (i.e., occupational title or job duties). The average coder will likely take the approach of coding according to the formal occupational title. However, the more appropriate code would be one reflecting job duties. For example, the "Assistant Manager" working in a branch bank functions as a loan officer. The code for "Manager, Branch Banking" is 186.118. Functionally, the occupation is that of a loan officer, code 186.288 or 249.368. The DOT provides no assistance in correctly coding an Assistant Bank Manager as a Loan Officer.

It is apparent, then, that different coders may decide differently about the use of particular codes. Consistency would require uniform policy decisions on these matters and their inclusions in the coding manual in order to achieve consistent application by all coders.

7. Occupations not included in the DOT. In spite of the fact that there are some 22,000 jobs defined in the DOT, there are occupations which have not been described or coded. In this area, some of the new products and production techniques in the wood products industry create jobs for which there is no specific DOT classification. Some firms continually review and up-date occupational titles so that they accurately describe the functional duties of the job. In such cases a problem arises because the new job titles are often unique to the firm and frequently not contained in the DOT.

   Faced with such a situation, a coder is forced to assign such an occupation to a DOT class which is not totally appropriate, partly because there are no intermediate levels of detail which can be used for such cases. There are also various aide categories such as Library Aides, and Surveyors Aides, which are not included in the DOT.

8. A lack of usable, general categories. Generaly speaking, the DOT is too detailed for the purposes of a skill survey. This is probably the greatest single source of trouble in occupational coding. The uses to which skill surveys are

> put do not require the great detail contained in the DOT, nor do the data permit analysis to that level of detail. Nevertheless, there is no convenient way, as in the S. I. C. system, to operate at a slightly more general level of detail. The option open to the analyst is either to use the complete six or nine digit detail or to use such broad categories that the meaning of the data is frequently obscured. This problem, combined with the sometimes general nature of job titles on the questionnaires, creates the necessity of arbitrarily assigning codes, quite specific in nature, to the more general job titles which are generally listed on the employer questionnaires. For instance, the DOT lists eight different three-digit codes for welders: arc welder, 810., gas welder, 811., combination welder, 812.884, resistance welder, 813., braze-welder, 814., lead burning occupation, 815., flame cutters and arc cutters, 816., welders N. E. C. 819. The coder is faced with the impossible task of deciding which of the eight codes should be assigned to the employer questionnaire entry for "welder." This is not only undesirable on methodological grounds, but these fine distinctions are unnecessary for the purposes of analysis. In the case of welders, for example. the total category of welders made up only 1/5 of 1% of employment in Lane County. To further divide this occupation into eight separate classifications would probably be spurious, and, at best, unnecessary.

It would undoubtedly be possible to reduce coding error somewhat by application of highly skilled technical manpower to the coding job, though this practice would create a serious staffing problem, and it would probably not completely solve any of the above problems. Some error must be accepted as long as the DOT is used. The coding evaluation in the Eugene study led to the conclusion that perhaps as many as five percent of the items would be subject to question even if the coding were done by experts. This conclusion is consistent with the experience of highly skilled occupational analysts dealing with C. P. S. data.

In attempting to code C. P. S. returns to DOT, the U. S. Employment Service found difficulty in coding 6 percent. "The most common problems involve either insufficient information to relate the job to any DOT classification, or a job that could convert to too many DOT classifications."[20]

Item 7 in the above list, the treatment of occupations not already included in the classification system, is a matter of considerable importance in a dynamic labor market. It is important for an occupational coding system to be able to absorb new or restructured occupations without obscuring them. The Functional Classification of Occupations does this by permitting "zero" coding in detail cells when existing definitions do not fit positions to be coded. That is, the coder is not required to force an occupation into an existing detailed code as in the DOT. Further analysis of such hard-to-code occupations and updating of the coding system would be indicated in categories with large numbers of zero coded occupations. Changing or adding occupational definitions could then be done to reflect the new, emerging occupational structure. In the meantime, employment in new occupations is not lost or obscured, but appears in the correct functional group totals. This procedure not only facilitates updating but improves opportunities for analysis of emerging occupations.

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[20] Leon Lewis, "Development of a Convertibility List Between the D. O. T. and Census Classification Systems," 1966 Proceedings of the Social Statistics Section of the American Statistical Association, p. 205.

Operational Effectiveness of the Functional Classification of Occupations

A Functional Classification of Occupations has been tested in one actual field research situation, from which some indication of its operational effectiveness can be garnered. That study was designed to cover

> . . . all employment in State government, counties, cities, and special districts as well as the private social agencies which provide social services, recreation, or economic assistance. It did not include public or private agencies whose principal activity is the delivery of health services (hospitals, nursing homes, health research association, etc.) or educational services (public or private schools, colleges, and universities, day care centers, etc.) nor did it include religious or fraternal organizations.[21]

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[21] Bruce McKinlay, Community Service Manpower in Oregon (Eugene, Oregon: University of Oregon, Bureau of Governmental Research and Service, 1969), pp. 3-4.

A functional classification system was used to code occupational data reported by 445 employing units. Trained but inexperienced interviewers classified the employer data, using a code book developed by the project staff, with technical assistance from the Research Section of the Oregon Employment Division. The code book incorporated the occupational titles in general use in Oregon community service agencies with occupational definitions from the Dictionary of Occupational Titles (some of which were slightly modified). The definitions were then grouped according to the principle of functional classification into 25 clusters and into the five broad functional groups described earlier. A four-digit code was then assigned to permit automatic data processing. The code followed the conventional system of designating the broadest groups (five functional groups) with the first digit, intermediate groups within the broad groups (clusters) by the second digit, and detailed categories (specific occupations within clusters) by the third and fourth digits.

The Functional Classification of Occupations performed well in this test.

> All told, fewer than 2 percent of the 9,000 occupational entries in the study were mis-coded. This is a particularly low number in view of the fact that neither the code system nor this code book had been tested before and that much of

the coding was being done by inexperienced personnel. This 2 percent error rate can legitimately be compared with the error rate of previous manpower studies in which the Dictionary of Occupational Titles was used. Those studies also involved employer surveys seeking essentially the same kind of information in essentially the same format as the Community Services Manpower Study. In those studies, error rates approaching 15 percent were found when the Dictionary of Occupational Titles was used to classify the field data. While those studies covered a wider range of occupations, and therefore would be expected to have a higher error rate, the difference must be at least partially attributed to the difference in classification systems.

Not only was the overall error rate substantially lower than in the cases in which the Dictionary of Occupational Titles was used, there was no significant quantity of cases in which the appropriate classification was totally ambiguous.

A visual inspection of the errors in this study further suggests that a fairly significant portion of the 2 percent is simply clerical error which cannot be ascribed to the code system itself.

Additionally important is the fact, which is indicated by the data in the following table, that the great majority of errors occurred at the least significant and hardest to apply third and fourth digits of the code. In the cases where the code was clearly misapplied, the error was not only at the finer levels of detail but usually involved a discrepancy of only one number. By way of summary, it can be said that errors tended to occur in the most detailed and therefore hardest to apply third and fourth digits of the function code; moreover such errors as did occur in those digits tended to be close to the correct code. This study, at least, leads to the conclusion that the functional classification system is operationally successful in the processing of data from an employer survey.

This Functional Classification of Occupations provided a very useful classification of the occupational data for analysis of manpower problems, in that it reflects the functional, departmental organization of most Community Service activities.

TABLE 8

ERRORS IN FUNCTIONAL OCCUPATIONAL CODING

	Number	Percent
Total Records	9,049	100.0
Total Changes (first four digits)	148	1.6
Changes in the:		
Fourth Digit	78	0.8
Third Digit	34	0.4
Second Digit	12	0.1
First Digit	24	0.3

It is also worth noting that the Functional Classification developed for the processing of employment data adapted very easily to the classification of most of the education programs and short courses identified as another part of this study. The prospect of a single classification system which can handle both employment and educational data is encouraging to anyone who has wrestled with the problems of relating education and employment.[22]

It has already been noted that part of the operational as well as conceptual advantages of the Functional Classification of Occupations over the DOT and other socio-economic classification systems is that the Functional Classification of Occupations more closely reflects establishment industrial and departmental organization of occupations. Thus it is relatively easy to find the right occupational area (the right cluster), and then to identify the specific occupation. This operational advantage undoubtedly accounts for the experience reported in Table 8, which shows the preponderance of error at the most detailed (and for many analytical purposes less significant) levels.

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[22] Bruce McKinlay, Methodology for the Community Service Manpower Study (Eugene, Oregon: University of Oregon, Bureau of Governmental Research and Service, 1969), pp. 6-8.

It is important in interpreting these particular data to recognize that the Functional Classification of Occupations reflects the industrial peculiarity of many specific occupations. This fact undoubtedly contributed to the excellent performance of the Functional Classification of Occupations in handling occupations in the Oregon Community Service Manpower Study, which was an industry study. But even in a study covering all industries the Functional Classification of Occupations would have an operational advantage when the study is based on establishment data, because the Functional Classification of Occupations reflects the industry stratification of occupations upon which establishment surveys are invariably based. Thus, a reduction in classification errors would be a probable consequence of use of a Functional Classification of Occupations rather than a socio-economic status system in a broad-scale employer survey.

The Industry- Occupational Coefficients Matrix Method. --A recent methodological innovation in the development of occupational employment estimates and projections enhances the attractiveness of the Functional Classification of Occupations. That innovation is loosely called the "industry-occupational matrix" approach. The industry-occupational matrix method was developed in response to loud criticism of the one-shot area skill survey method and as a way of taking maximum advantage of established industry data producing and employment projecting methodology.

Rather than estimating occupational employment directly, the matrix approach constructs percentage distributions of employment by occupation for each of several industries, which can then be applied to independently derived estimates of total industry employment. Industry employment totals can be generated by any of the various well developed projection methods and can capitalize on substantial historical data series. Once industry estimates or projections are completed, and the occupational coefficients applied, occupational totals are derived by cross aggregating the various industry details.

The matrix approach has several advantages. The use of occupational coefficients permits systematic attention to employment patterns in each industry. It is also most practical for

Fig. 4.--A simplified industry - occupational coefficient matrix

Occupation	Industry A	Industry B	Industry C	Industry D	Industry E	Industry F
Total	100%	100%	100%	100%	100%	100%
1						
2						
3						
4						
5						
6						

forecasting occupational needs, since existing, reasonably sophisticated tools for estimating and forecasting industrial employment can be applied. Another of the advantages of the matrix system is that it economizes on broad-scale field surveys.

> Over a period as short as 6 to 10 years there is probably a relatively stable occupational structure within many industries. If this is so, a set of good occupational patterns for a base period and good projections of employment for each industry comprise a major step toward projections of employment by occupations.[23]

There have been increasing numbers of applications of the matrix technique in recent years, using various data sources. One of the first attempts to apply this approach was made by Don Mayall in his study of the San Francisco Bay Area.[24] The currently recognized guide to this projection method is Tomorrow's Manpower Needs (four volumes) which suggests regression methods for projecting area industrial employment and the use of B. L. S.-developed national industry-occupational matrices to generate occupational data.[25] One of the major studies to apply such a method was Manpower Directions, New York State, 1965-1975.[26] That is one of several studies conducted by the New York Department of Labor over the past several years using a matrix approach, and one of the first to generate area as well as state-wide data. That study used Census data for the matrix, as does the B. L. S. methodology. By far the most extensive application of the matrix method using establishment data is the work of the Utah Department of Employment Security whose series of reports on state occupational employment uses a matrix 3,000 9-digit DOT occupations by 90 industries.[27]

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[23] Greenspan, "Estimates of Employment Requirements by Occupation for Future Periods--Data Sources and Model Development," Long-Term Manpower Projections, p. 46.

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[24] Donald Mayall, Manpower Resources of the San Francisco-Oakland Bay Area, 1960-1970 (San Francisco: State of California, Department of Employment, 1963).

[25] U. S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. I-IV.

[26] New York State Department of Labor, Division of Research and Statistics, Manpower Directions, New York State, 1965-1975, Vol. I-II (n. p.: State of New York Department of Labor, March, 1968).

The most complete evaluation to date of the matrix and other approaches to occupational employment estimating and forecasting has just been completed by the Wisconsin State Employment Service. With U.S. Labor Department support, that agency tested and evaluated five methods in terms of the vocational education planning needs, including the Census-based B.L.S. matrix and various formats of employer surveys. Their conclusion after completion of this very large scale effort was:

> On the basis of in-depth analyses of all five methods tested by PROJECT VISION, it would appear that the occupational information needs of the vocational education system probably can best be served by a simplified and modified Area Skill Survey technique. The most important steps to be taken to develop such a model technique would include programming it on a frequent, recurring schedule; shortening the occupational requirement forecast period; and sharpening the occupational and employment language tools used by the Employment Service, industry, and educators. There would always be an important place for

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[27] Richard "A" Brown, Detailed Occupations of Nonagricultural Wage and Salaried Jobs in Utah, 1960-1975, Special Manpower Report Series, Report No. 5 (Salt Lake City: Utah Department of Employment Security, April, 1969).

> certain aspects of the other techniques, the use of which would be dependent on the industrial character of any particular labor market area and the availability of research facilities.[28]

Though there is still considerable experimentation going on and much evaluation still to be done, it does appear that the matrix approach, probably using establishment-based matrix coefficients, will receive increased use.

The Functional Classification of Occupations has particular operational pertinence in such methodology specifically because the Functional Classification of Occupations follows more closely than other occupational classification systems the industrial stratification upon which such surveys must be based. This classification system, then, makes surveys of specific clusters or functional groups more practical precisely because many (though by no means all) of the clusters are related to a limited number of industries. The blank matrix cells in a Functional Classification of Occupations organized industry-occupational coefficients matrix reflect the limited industrial dispersion of many related occupations and indicate the industries which must be analyzed in order to discover occupational trends in the occupational cluster in question.

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[28] Wisconsin State Employment Service, A Division of the Department of Industry, Labor and Human Relations, PROJECT VISION, An Experiment with Occupational Needs Projection Techniques (n. p.: Wisconsin State Employment Service, 1970), p. 6.

Thus, in addition to its several conceptual advantages, the Functional Classification of Occupations has certain operational appeal, especially when applied to establishment data. These operational advantages grow out of the Functional Classification of Occupations' correspondence to the functional organization of occupations in establishments. This correspondence probably accounts for much of the superior performance of the system as judged by the rate of coding error in the one field research test of the system. These operational advantages make the Functional Classification of Occupations particularly attractive as a coding system for the emerging industry-occupational coefficients matrix approach to occupational employment estimating, especially when the matrix coefficients are based on establishment data.

CHAPTER VI

ANALYTICAL ADVANTAGES OF THE FUNCTIONAL CLASSIFICATION OF OCCUPATIONS

How well does a Functional Classification of Occupations serve the major needs for occupational data? The most relevant classifying principles for each of five major users of occupational data were defined, or at least approximated, in Chapter II along with the amount of precision and level of detail required for each use. A review of existing classification systems in Chapter III confirmed that none of the existing classifying systems meet all or even a majority of these needs. Nevertheless, there are pressing reasons of data reporting and planning efficiency why a single, broadly applicable data classification system is much to be desired. The question now is, can a Functional Classification of Occupations, with its conceptual and operational advantages, succeed where others have failed in meeting the analytical data needs of the five major uses of occupational information?

Now that the classifying principle has been defined and occupations have been classified, at least provisionally, on the functional basis, it is both possible and desirable to assess the analytical applicability of this principle to the five major needs for occupational data described in Chapter II.

In each of the sections which follows, the earlier conclusions about data needs will be summarized briefly, then the applicability of a functional classification of occupations will be assessed.

Usefulness of a Functional Classification of Occupations for General Policy Considerations

The earlier discussion of information needs revealed that general policy considerations require occupational data in broad, rather than specific groupings, and relatively long rather than short-term projection periods. The level of detail of occupational clusters seems quite appropriate for policy analysis and for long range forecasting, because clusters deal with occupations in relatively broad aggregates and because they contain occupations which share common functions.

The greater issue here, however, is the appropriate classification principle. The analysis in Chapter II concluded that education is an important factor, but that similarity of educational field is more important than formal educational level, since knowledge of substitutability among occupations is important to policy formulation. For this purpose, an occupational classification should be one which co-classifies occupations with inter-relationships which are fixed by technology or other factors.

A functional classification does precisely that. Occupations within clusters do, on the whole, share a need for certain types of education, and occupations with traditional, if not technologically determined, coefficients most often have common economic functions and are therefore co-classified in a Functional Classification of Occupations. Consequently the relationships among occupations within functional analytical categories are surely more stable and definitely more predictable than the relationships among occupations in the broad socio-economic groups of present classification systems. Additionally, similarity of educational subject matter is emphasized rather than the level of such preparation.

General purpose occupational data presented in terms of a Functional Classification of Occupations consequently appear quite pertinent for manpower policy considerations and for analyzing the manpower consequences of other types of policy decisions.

Usefulness of a Functional Classification of Occupations for Curriculum Planning

A classification system embodying three levels of detail, such as those used in the provisional Functional Classification of Occupations, would be especially pertinent for curriculum planning purposes, because occupationally oriented instruction ranges from broad exploratory courses to highly specific preparation for immediate job placement. Correspondingly, varying degrees of accuracy in occupational data are required.

The available literature on occupational education curriculum planning proved in Chapter II to be of limited usefulness in identifying the most appropriate classifying principle for the necessary occupational data. Nevertheless it appeared that much of the information needed for curriculum planning has to do with the skill content of occupations and the transferability of trained personnel among occupations, despite the fact that educators are inclined to speak in terms of the narrower concept of teachable content. The "curriculum-area" type of classification which is implied by the concept of teachable content proves to be both conceptually and operationally difficult to specify and not at all satisfactory for other occupational data uses. Nevertheless, curriculum planning remains in serious need of an alternative to socio-economic data.

For both introductory and exploratory curricula, where a general introduction to the structure and job content of the labor market is desired, the broad functional groups and the occupational clusters of a Functional Classification of Occupations seem appropriate, emphasizing as they do the major types of economic activity to which various occupations contribute.

At the high school level occupational education is designed to provide students with basic technical skills which will serve as a foundation for a variety of related occupations, while at the same time making it feasible for secondary schools to offer a sufficient variety of occupational programs to meet the needs of most students. The clusters of the functional classification system seem to provide quite an appropriate basis for organizing such curricula, because they reflect similarities of function and broad skill areas. Furthermore, they meet the vocational educators' stated need for groupings of occupations having certain types of skills and knowledge. Although the functional occupational clusters do not classify occupations explicitly on the basis of their similar knowledge, the occupations within most clusters do exhibit skill and knowledge similarities, and a basic, core curriculum appropriate to all occupations within the cluster is rather readily apparent in such clusters as clerical, engineering and design, mechanical, metal working, sales, social services, and others. The applicability of functional clusters for the curriculum planning process is further documented by the frequent similarity of clusters between the functional classification and the curriculum area classification. In this connection, it is noteworthy that the U.S. Office of Education instructional areas include such titles as business, agriculture, health occupations, and office occupations. The functional clusters look like these curriculum groups in a good many cases, but they avoid the main dangers and limitations of the curriculum groupings.

One of the measures of a successful occupational education program is the capacity of graduates for employment upgrading as evidenced by greater responsibility and rising incomes.[1] A Functional Classification of Occupations has distinct advantages in this regard as a basis for curriculum organization. A functional classification of occupations reflects the present organization of occupations within employing institutions and groups together occupations with common basic skills, so it helps to identify groups of occupations within which occupational upgrading is most likely to occur and can best be planned for.

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[1] See Ray Marshall, "Reflections on Upgrading," Manpower, II, No. 1 (January, 1970), pp. 3-7.

The earlier analysis of occupational education's need for occupational data concluded that specific occupational training, whether in high schools, community colleges, universities, or on-the-job, needs ultimately to deal with specific occupations, not with groupings of occupations. Where complete qualification for employment is the educational goal, precision and detail are data requirements, and special studies may be required to supplement general purpose data. The specific occupations proposed for a Functional Classification of Occupations, together with their "occupational specialties," appear quite appropriate for this most specialized aspect of occupational education. Moreover they reflect the occupational groupings actually used in most specifically occupational preparatory programs. At this level, a Functional Classification of Occupations follows the universal practice of defining occupations in terms of job duties, and any problem with the use of the system's specific occupations probably arises from a lack of appropriate information about the occupation rather than from a weakness in the occupational categories themselves. In any case, statements of data needs for specific occupations have little to do with the broader analytical groupings of any analytical classification system.

In summary, it appears that the three levels of detail embodied in the Functional Classification of Occupations are highly appropriate for education planning in general and curriculum planning in particular. A Functional Classification of Occupations' functional groups and clusters also seem conceptually superior to any other occupational classifying principle for exploratory programs. For intermediate level skill development programs, the Functional Classification of Occupations' clusters seem superior to either socio-economic or worker trait groups. They are probably also superior to the curriculum area groups because they do reflect skill and knowledge similarities, but avoid the serious weaknesses of a curriculum area system. At the detailed occupational level, where specific occupational training must occur, the conventional job duties definitional base, used by the Functional Classification of Occupations and other classification systems, seems quite satisfactory.

Some further discussion of occupational education curriculum planning is called for, because one of the recurring themes in discussions between education planners and employers is the employers' contention that the development of appropriate work attitudes should be a stated and high order objective of education. At the same time, both new and old occupational education programs continue to place heavy emphasis on manual and mental skill development, leaving interpersonal relations and attitude development to occur casually. The vocational educator's concept of "teachable skills and knowledge" is perhaps symbolic of this limited view of the role of occupational education, implying, as it does, confinement of the curriculum to skills and knowledges (not attitudes) which are "teachable," presumably in the traditional classroom or school laboratory setting. Practically the only attempts to deal with this matter are the limited work experience programs wherein schools temporarily place students in employing establishments so they can experience the "occupational environment and its situations." Even then, however, the learning is highly casual, with schools doing little more than permitting it to occur.

The admonitions of employers--teach responsibility, initiative, good work habits, etc.--seem totally non-discriminating as to the particular attitude requirements of different types of occupations. Psychological research on work attitudes has been equally non-discriminating. Most such research has discussed work values in relation to the Protestant Ethic and/or socio-religious characteristics of workers.[2]

In summarizing some of his own research, Blood says that future research should investigate the relationship between work values and work satisfaction. He observes that "Perhaps higher job satisfaction is partly a congruence between individual and institutional goals."[3] Refinement and expansion of analytical techniques are called for. If satisfaction (and perhaps productivity) is enhanced by this congruence, the recognition of different institutional or occupational goals is important, lest it be inferred that there is a single set of individual goals or attitudes which is appropriate to all work. It is apparent that different types of occupations require different sets of work habits, attitudes, and social skills as well as manual and mental skills. Politeness is more important to the sales person, and cleanliness is more important to the waitress, than the knowledge of cash register operation is to either one.

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[2] Milton R. Blood, "Work Values and Job Satisfaction," Journal of Applied Psychology, LIII, No. 6 (1969), p. 456.

[3] Ibid., p. 458.

The Functional Classification of Occupations may provide a useful way of dealing with these topics, because it reflects not only technical skills but also interpersonal relationships and other functions which are significant to job performance. The structure, at least at the broad functional level, appears to reveal the unique way in which persons employed in various functional groups view their jobs. A technician for instance, seems to view his job differently from a production worker. He concentrates on the application of his knowledge in the performance of some complete and technical job, rather than seeing his function in strictly quantity terms as is characteristic of production workers, and he does so despite the fact that he is no more skilled than many production workers. Similarly it seems apparent that people in direct service occupations share certain attitudes about working for people's presumed good which contribute to their own satisfaction and occupational effectiveness and are distinct from workers in other broad functional groups.

Research reported in the 1968 Manpower Report of the President indicated that there are differences in the amount of job satisfaction expressed by various groups of workers and that factors such as interesting work, security, and co-workers weigh differently in the calculations of job satisfaction of different groups of workers.[4]

A Functional Classification of Occupations would seem to be a useful framework both for further research in this area and for the integration of explicit attention to these matters into occupational education curricula.

Usefulness of a Functional Classification of Occupations for Vocational Guidance

The need for occupational information in guidance activities varies, because career choice is a developmental process which requires different amounts of information and different degrees of specificity as different stages in the process. In Chapter II we saw that the appropriate level of detail depends upon the stage in the career choice process. Accuracy of occupational employment data was not seen as an important criterion, because guidance is an individualized process which takes into account many other factors besides labor demand. Approximations of trends and directions of change are as useful for guidance as precise projections. Finally, the review of guidance literature left some ambiguity as to the most appropriate classifying principle, but permitted the conclusion that several characteristics of the job and characteristics of workers should at least be reflected in the system, whatever single variable is used as the basis for classification.

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[4] U.S. Department of Labor, Manpower Report of the President (Washington, D.C.: U.S. Government Printing Office, 1968), pp. 47-56.

The Functional Classification of Occupations does meet the requirements of varied levels of occupational detail suggested by the developmental stages theories of Ginzberg and Super. Both the functional groups and clusters seem to be manageable ways of encompassing the array of occupational areas potentially open to a person in the exploratory stages of career choice. But is the classifying principle one which facilitates the recognition of the numerous job attributes and the various worker traits which are pertinent? The Functional Classification of Occupations would seem to be as useful as any job-duty based system as a way of defining and grouping characteristics of the job; and as has been argued previously, it is probably more appropriate than socio-economic data systems, in that it highlights similarities of types of education and facts of labor market organization which are probably more pertinent than status level, at least in the exploration of occupational opportunities.

The other type of requirement in vocational guidance is a [illegible] dealing with worker traits. It was noted in Chapter III that [illegible] duty classification systems do not deal adequately with worker traits, but worker trait classification systems either show too little commonality among the occupations within the groups or are not useful for other than guidance purposes. The clusters of the Functional Classification of Occupations do exhibit some worker trait similarities which suggest that the Functional Classification of Occupations may be useful in considering worker traits for guidance purposes.

Taking the DOT list of eight worker traits as an inventory, one can see some relationship between clusters and types (though [illegible] levels) of aptitudes, interests, temperaments, physical demands, work conditions, industry, and work performed. Of the eight worker traits in this list, only training time is completely obscured by the Functional Classification of Occupations clusters. Looking specifically at the worker traits which received the greatest attention, aptitudes and interest, one can see that there are some definite linkages with the clusters. With regard to aptitudes, relatively high verbal aptitudes are significant requirements throughout the administrative cluster, sales cluster, and social service cluster; similarily numerical aptitudes are essential in engineering and design, social research and planning, and laboratory occupations.

Clusters can also be identified where significant use of spatial, form perception, clerical, manual dexterity, and other aptitudes are found, even though the specific level of usage may vary within the clusters.

Turning to interests, the various interest categories seem to be revealed even more clearly in the clusters of the Functional Classification of Occupations. Some of the clusters, though based on job duties, look very much like the interest test categories used by Strong, Kuder, and others, and have strong resemblances to the Roe categories but without the problems inherent in attempts to classify occupations on the basis of worker traits. It is a simple matter to identify clusters which provide expression for the workers' interests in scientific matters, social welfare, material (working with tangibles), record keeping, and contact (dealing with people for material gain). The Functional Classification of Occupations clusters are not an interest classification system per se, and they do not perfectly parallel the categories of vocational interests identified by interest test developers and by Ann Roe. However, they do exhibit concentrations of these interests, so they seem to be a highly useful basis for vocational guidance, not only when job duties information is required but also when aptitudes, interests, and other intrinsic characteristics are under exploration. Thus, though the clusters are based on job duties, they do reflect worker traits and are therefore potentially helpful to vocational guidance by reflecting important personal variables.

This whole discussion of the ability of a Functional Classification of Occupations to reflect worker traits has its parallel in the preceding section's discussion of work habits and attitudes, which in a very real sense are a type of or reflection of worker traits, and certainly a subject for vocational guidance.

In addition to its similarities to the various categories of worker traits, the Functional Classification of Occupations avoids one of the inherent dangers in the unsophisticated use of a socio-economic system for guidance. Implicit in any classification system which attempts to rank occupations by some measure of level is the conclusion that one should aspire to reach the top of that scale. Thus, a professional level occupation appears as a more desirable goal than any other, and a person would choose another occupation only as a stop-gap measure or because he is admittedly of limited talent. A job family system such as the Functional Classification of Occupations avoids this exclusive attention to attainment of status, emphasizing instead the choice of an appropriate area of work for the application of the individual's interests, abilities, goals, etc.

This discussion suggests that a Functional Classification of Occupations comes much closer than socio-economic classification systems to meeting the occupational information needs of vocational guidance, both by avoiding the excessive emphasis on status and by revealing categories of occupations which reflect worker traits as well as types of job duties.

Usefulness of a Functional Classification of Occupations for Industrial Location and Wage Decisions

The analysis in Chapter II showed that industrial location and wage decisions require occupational data with both detail and precision; moreover the most relevant basis for categorizing the data has to do with job duties and with the organizational units wherein the work is performed.

The Functional Classification of Occupations is based upon job duties, as are the existing socio-economic status systems, but it reflects the typical organizational structure of work units much more clearly than do any of the other classification systems with the possible exception of an industrial classification. Even so, the Functional Classification of Occupations has certain advantages over a strictly industrial classification system, in that it reflects departmental similarities among various industries. The occupational clusters facilitate the maintenance of wage consistency within establishment occupational series by presenting data about occupations which serve the same function and are therefore most appropriate for wage comparisons and for manpower recruitment. Throughout the system, the clusters reflect groups of occupations where wage comparisons are most likely to be made. In certain instances, the system also facilitates inter-industry comparisons by juxtaposing occupations which serve similar functions, even though they may be employed in different industries. The laboratory cluster is a prime example of such a situation, where laboratory scientists and technicians from research, quality control, and medical laboratories are grouped together, facilitating comparison of like jobs in different industries.

This same feature improves the analytical potential of occupational data for industrial location decisions by helping to identify supplies of manpower, not only in the precise occupations required by newly locating firms but also in occupations within the same job family which have closely related skills and other relevant characteristics.

Thus, the Functional Classification of Occupations clusters seem to be an analytically useful categorization for industrial location and wage decisions, but it should be remembered that these uses are most in need of precise information about relatively detailed occupations. The Functional Classification of Occupations is superior to either the Census or the DOT classification system in this respect also. Because the existing systems require a full coding of every piece of occupational data, they sometimes force the classification of unusual jobs into categories where there is not a precise fit. Some of the problems raised by such a system were discussed in Chapter V where the limitations of present occupational data were discussed. By contrast the Functional Classification of Occupations permits partial coding where incomplete information or peculiarities of particular positions make complete coding spurious; this feature facilitates the maintenance of a rather high degree of homogeneity within occupation and occupational specialty categories. This is highly advantageous where precise information about detailed occupations is required.

In conclusion, it is apparent that only job duty based classification systems are appropriate for industrial location and wage decision purposes. Of the two job duty types, the socio-economic systems and the Functional Classification of Occupations, the latter seems to have certain advantages. It permits the maintenance of a high degree of homogeneity within occupation and occupational specialty categories because it does not require the fully detailed coding of every single job. In addition, by bringing together occupations with similar functions in the same clusters, it facilitates analysis of occupations within similar organizational structures for wage comparisons and labor supply appraisal purposes. General purpose occupational data presented on this basis would seem to be more useful than the same data presented in terms of socio-economic status group.

Usefulness of a Functional Classification of Occupations for Special Purpose Studies and Projects

In Chapter II, it appeared that general agreement could be reached on a detailed listing of occupations for which general purpose data would be useful in special purpose studies and projects. Such data would have substantial utility for research if time-series consistency and compatibility with other social statistics could be established and maintained. For many research purposes it appears that great precision may be less important than consistency and compatibility. There is probably little likelihood of identifying a single classification system whose broader, analytical categories would meet the diversity of needs posed by special purpose studies and projects, but this is not an insurmountable problem as long as the number of detailed occupations remains small enough to make special purpose classification feasible.

It appears that little can be said in support of (or in opposition to) a Functional Classification of Occupations, or for that matter any other classification system, as the single occupational classification system for special purpose studies and projects. Even though agreement might be reached on definitional categories, analytical needs are so diverse that no single analytical classification system is generally applicable.

It does seem, however, that the Functional Classification of Occupations, by virtue of its applicability to manpower policy, occupational education planning, vocational guidance, and industrial location and wage decisions would have certain merits for special studies and projects in these prominent areas of educational and labor market research. Similarly, it seems on the face of it, that studies in a variety of areas which make only limited recourse to occupational data would find data concerning the broad economic functional groups of the Functional Classification of Occupations more analytically useful than the one-digit socio-economic groups which are now available. This by no means qualifies a functional classification as a universally applicable system for special purpose studies and projects, however.

One virtue of the Functional Classification of Occupations is that the principle of occupational function is itself a relatively value-free basis for occupational classification, and it is therefore to be preferred for analytical work. Like industry, occupational function carries few connotations of goodness or badness. Thus it frees the data user--economist, sociologist, job seeker, or guidance counselor--from the necessity of guarding against unwarranted conclusions growing out of the classification system itself. By contrast,the amount of education or the social status attached to an occupation result in a description of occupations in terms of greater or lesser amounts, and carry with them implicit judgments of better and worse. Conclusions regarding the worth of occupations should be based on explicit statements about the basis for such judgments (pay rates, employment prospects, social status, etc.) not on implications arising from the occupational classification system itself. It is clear that the neutrality of the Functional Classification of Occupations is advantageous not only for analytical and other special purpose studies, but also for the policy making, educational planning, and, in particular, vocational guidance.

It was noted in the discussion of occupational data needs for special purpose studies and projects that special purpose classification for analytical reasons would be feasible if the detailed occupational groups were not too numerous. As was pointed out earlier, the concept of occupational specialties provides a good way of handling unusual variations of a particular occupation without defining each as a separate occupation and hoping to develop complete sets of quantitative data for them. The effect of this feature of the Functional Classification of Occupations is to limit the number of occupational definitions and thus increase the practicality of specialized classification for special purpose studies.

Comparability is, of course, an extremely important characteristic of general purpose data whenever substantial time series are in use, and a proposal for change in a classification system must be evaluated, in part, for its effect on comparability. Comparability is difficult enough to maintain in the face of changes in the social phenomenon being measured and changes in research methodology, without introducing non-economic classification changes. At the extreme, Hodge and Siegel argue that comparability in Census data is of the highest priority.

Although we have argued in this paper that several advantages might be expected to accrue from attempts at

> revising the detailed census code in order to achieve greater homogeneity within detailed occupations, we do not believe that those revisions and the advantages which might flow from them warrant sacrificing intercensal comparability in any degree.[5]

Though complete comparability is much to be desired, few researchers give it such a high priority. Jerome B. Gordon says of occupational classification revision:

> While the comparability issue is a constraint in the consideration of alternative occupational classifications, it is not a rigorous one. Supplemental classification schemas have been devised and used with the existing Census occupational structure. Limited departures from the existing codes, in the directions desired by the current crop of critics can be handled without much degradation in comparability.[6]

On the other hand, Stanley Lebergott, himself well experienced in the use of historical Census data series, flatly rejects Hodge and Siegel's insistance on intercensal comparability at all cost. Of this demand he says:

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[5] Robert W. Hodge and Paul M. Siegel, "The Classification of Occupations: Some Problems of Sociological Interpretation," 1966 Proceedings of the Social Statistics Section of the American Statistical Association, p. 190.

[6] Jerome B. Gordon, "Occupational Classification: Current Issues and an Interim Solution" (New York: Columbia University, Bureau of Applied Social Research) 1968, p. 9.

> It is wrong. The Census data are primarily used for clear and present problems. As these problems change, as our insight grows, we must make changes. Since the structure of any government agency, and its scholarly advisory committees, normally slows down the rate of change, I also think it is superfluous to be worried about the rate of change in the classification.
>
> It is unnecessary. Given modern sampling and modern computers, samples of the micro observations can be maintained and recombined in any scheme that a scholar may desire.[7]

Thus it appears that, while comparability is widely desired by users of occupational statistics, there is by no means complete agreement on the priority it should be given in considerations of occupational classification system changes.

At issue here is the amount of comparability which it is possible to maintain, if a change were made from the existing socio-economic systems used by the Census Bureau, the Bureau of Labor Statistics and the Employment Security Agencies to a functional classification of occupations. At the definitional, detailed occupational level, there is no necessary conflict between a functional classification and the existing classification systems. As has been pointed out repeatedly, the definitional categories, the detailed occupations, are based on the same criterion, job duties. It has been argued that greater homogeneity of detailed occupations might be maintained and unquantifiable detail avoided with a detailed classification of the type proposed, but neither of these features requires substantial departure from the existing detailed occupational categories for which data have historically been produced.

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[7] Stanley Lebergott, "Discussion of The Classification of Occupations: Some Problems of Sociological Interpretation" by Robert W. Hodge and Paul M. Siegel. 1966 Proceedings of the Social Statistics of the American Statistical Association, p. 207.

In the broader analytical categories, of course, a Functional Classification of Occupations differs from the socio-economic status groups. However, certain traditional analytical categories remain. The traditional distinction between production and non-production workers is maintained and sharpened; there are great similarities in the content of the sales, clerical, and management groups, and other sub-groups of the Census have their near counterparts in the clusters of the Functional Classification of Occupations. Thus the Functional Classification of Occupations, while it is a major change, is not a total departure from familiar categories of occupations.

Conversion to a Functional Classification of Occupations does not create an insuperable break in occupational data time series, because a very high degree of consistency is maintained at the definitional, detailed occupational level. Maintenance of new data on the old classification system is possible as is the reclassification of historical data to the new basis. The Functional Classification of Occupations departs from the existing socio-economic systems in two principle ways: (1) It is definable in terms of the single concept--function--rather than a conglomerate of several as the socio-economic systems are, and (2) it leaves occupational level for separate stratification, which it properly is, rather than mixing it with the job family designation as the socio-economic systems do.[8]

It was argued earlier that compatibility between occupational employment and other social statistics is equally important to time-series comparability, and such compatibility is now largely lacking in the socio-economic series. This situation exists in part because variables which might be cross-classified--income, educational level, etc.--are included in one way or another in the occupational definitions themselves, making independent analysis next to impossible. A Functional Classification of Occupations, being based on a single classifying variable, tends to increase the consistency of current data series and to increase the independence of occupations for cross-classification with other social and economic statistics.

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[8] Besides sharpening the analytical power of occupational data, this latter attribute permits examination of the desirable number of occupational levels within an occupational field or cluster as a policy matter and as a way of alleviating manpower shortages. It does not treat it simply as a feature of the occupational classification system.

If the Functional Classification of Occupations is generally useful for various policy and program purposes as claimed, it could also increase the utility of occupational statistics for analytical and special purpose studies and projects for the reasons discussed in this section.

Manpower Substitutability and Internal Labor Markets

The use of a functional classification of occupations not only increases the homogeneity of individual occupational groups, but increases that homogeneity in a way which emphasizes the substitutability of jobs and workers within those groups. In economics, the substitutability principle is axiomatic to phenomonological classification. Cain, Hansen, and Weisbrod in their Monthly Labor Review article argue that a desirable occupational classification system is one which permits analysis of marginal choices by "production planners" in choosing various types of labor (or labor as opposed to capital) to minimize production costs, and one which also permits analysis of marginal choices by individuals regarding occupational entry and shifting from one occupation to another. ". . . the basic purpose of occupational classification for the economist is the provision of information about factor substitution possibilities. Occupational classes should therefore be relatively homogeneous, in the sense that a high degree of substitutability should exist within each class."[9]

> The fundamental position of this article is that occupational classifications can serve economists as part of a larger information system, a system designed to reveal more about the current and prospective labor-resource flexibility of the economy. We suggest that to be useful to economists occupational classifications need to be defined and developed with this objective in mind.[10]

Operational definitions of substitutability may be conceptual (i.e., sharing attributes which "should" make for substitutability between the occupations), or behavioral (i.e., reflecting actual substitution patterns), or both. A Functional Classification of Occupations advantageously incorporates both. As has been argued previously, such a system co-classifies occupations with similar sets of skill and knowledge requirements, thereby bringing together occupations which are, conceptually, substitutable. The flexibility of a free labor market, however, demands recognition of a behavioral definition of substitutability (on both sides of the market) as well. As James Scoville correctly points out:

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[9] Glen Cain, W. Lee Hansen, and Burton A. Weisbrod, "Occupational Classification: An Economic Approach," Monthly Labor Review, XC, No. 2 (February, 1970), pp. 49-50.

[10] Ibid., p. 48.

> For some jobs, there exists a range of "occupations," reported in the census of population, which satisfies the various skill, ability, and training requirements of the job. Depending on various circumstances (for example, the level of aggregate demand), the types and levels of skills and abilities brought to the job will vary. In part, this may reflect a loosening of requirements--the sort of thing that Melvin Reder claimed to observe over the business cycle, and which Wesley C. Mitchell saw as the source of some costs increases in prosperous times. Richard A. Lester has analyzed a tight labor market during the Korean War and concluded that the reduction of hiring standards was an important method of relieving shortages. In other cases, by a reorganization of the work pattern, different sets of qualifications may be accommodated to the job. For example, the extreme short-run necessity of obtaining substitute teachers can lead to different requirements, while various clerical and administrative facets of the job may be waived. An opposite case would exist in the use of overqualified personnel, such as that noted by Walter W. Heller in the underemployment of professional workers in times of general economic slack.[11]

Similar substitutions are, of course, possible on the supply side of the labor market because nearly all workers have occupational alternatives open to them by virtue of the education, training, and experience which they utilize in their primary occupation.

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[11] James G. Scoville, The Job Content of the U.S. Economy 1940-1970 (New York: McGraw-Hill Book Company, 1969), p. 16.

There is not an adequate source of occupational data which would permit empirical testing of the hypothesis that a functional classification of occupations recognizes operating manpower and occupational substitution patterns. However, a rough test can be made using interindustry labor mobility data developed by the Social Security Administration.[12] The use of industry data is possible because there is a rough, partial comparability between groupings of industry divisions and the broad functional groups of the Functional Classification of Occupations.

F. C. O. Broad Functional Group	Corresponding Industry Divisions
Organization Management	--
Technical Services	--
Production	A. Agriculture, forestry, and fisheries
	B. Mining
	C. Contract construction
	D. Manufacturing
Distribution	E. Transportation, communication, and public utilities
	F. Wholesale and retail trade
	G. Finance, insurance, and real estate
Direct Service	H. Services
	I. Government

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[12] Lowell E. Gallaway, Interindustry Labor Mobility in the United States, 1957 to 1960, Research Report No. 18 (Washington, D.C.: U.S. Department of Health, Education, and Welfare, Social Security Administration, Office of Research and Statistics, 1967).

If similarity of economic function is a significant determinant of mobility (and if it is adequately approximated with the available industry data), a concentration of relocations should occur within the functional group in which the workers were originally employed. If it is not a signficant determinant, the pattern of relocations might be expected to exhibit no concentrations, or to show concentrations in those industries with high wages and low unemployment rates. In analyzing the relationship of mobility to earnings, Gallaway found a significant, positive correlation. However, he pointed out that, "While this result is consistent with the theory of labor mobility as we have developed it, it certainly must be treated cautiously, for it explains less than 10 percent of the variation between the two variables."[13] Table 9 calculated from the Social Security Administration data, shows the patterns of interindustry mobility.

Table 9 shows the number of jobs in each of the major industrial divisions which were potentially available to workers from other industries, i.e., the total number of jobs in the industry in 1960 less the number of workers whose major employment was in the industry in both 1957 and 1960. If also shows the percent of those available jobs actually filled by men from each of the other

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[13] *Ibid.*, p. 46.

TABLE 9

INTERINDUSTRY MOBILITY PATTERNS OF U. S. MALES, 1957-1960

Industry of Major Job	Jobs Potentially Available in 1960 to Male Movers (in thousands)	Percent of Potentially Available Jobs Filled by Movers From:									
		A	B	C	D	E	F	G	H	I	Un-known
A. Agriculture, Forestry and Fisheries	2,988	-	3. 1	15. 1	30. 1	5. 6	26. 0	1. 6	10. 2	5. 1	3. 1
B. Mining	1,613	4. 1	-	19. 3	28. 0	8. 9	20. 0	1. 7	7. 4	3. 0	7. 7
C. Contract Construction	9,141	6. 0	4. 9	-	33. 6	6. 2	27. 0	3. 9	9. 7	3. 5	5. 2
D. Manufacturing	18,663	5. 4	4. 3	13. 2	-	6. 2	45. 0	2. 6	14. 1	3. 5	5. 7
Average for Production (A-D)		5. 2	4. 1	15. 9	30. 6	6. 7	29. 5	2. 4	10. 4	3. 8	
E. Transportation, Communications, and Public Utilities	5,298	3. 4	3. 0	11. 2	31. 6	-	30. 1	2. 0	12. 6	3. 9	2. 3
F. Wholesale and Retail Trade	17,930	4. 8	2. 4	11. 0	46. 0	7. 1	-	3. 8	17. 3	3. 7	3. 7
G. Finance, Insurance, and Real Estate	3,774	1. 8	1. 3	14. 0	26. 0	4. 3	29. 6	-	15. 7	4. 6	2. 6
Average for Distribution (E-G)		3. 3	2. 2	12. 1	34. 5	5. 7	29. 9	2. 9	15. 2	2. 8	
H. Service	11,656	3. 3	1. 9	10. 1	31. 3	5. 9	34. 3	4. 4	-	6. 3	2. 4
I. Government*	5,010	4. 5	2. 7	11. 4	28. 6	5. 9	26. 0	3. 5	16. 1	-	1. 4
Average for Service (H-I)		3. 9	2. 3	10. 8	30. 0	5. 9	30. 2	4. 0	16. 1	6. 3	

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*State and Local Government--executive, legislative, and judicial functions only.

Source: Lowell E. Gallaway, Interindustry Labor Mobility in the United States, 1957 to 1960 (Research Report No. 18) (Washington, D. C.: U. S. Department of Health, Education, and Welfare, Social Security Administration, Office of Research and Statistics, 1967), calculated from Appendix Table A-1.

industries. Reading down the columns of the table shows the disposition of movers from each of the industries. For instance, Column A shows that men who left that industry (agriculture, forestry, and fisheries) filled 4.1 percent of the mining jobs available to movers (from any industry). Other men who left agriculture between 1957 and 1960 filled 6.0 percent of the available construction jobs, 5.4 percent of the available manufacturing jobs, etc. Summarizing these percentages for "production," "distribution," and "service" groups shows that men who left agriculture (a production industry) filled more of the available jobs in other production industries (an unweighted industry average of 5.2 percent) than they did jobs in either distribution (3.3 percent) or service (3.9).

If behavior were random or if unemployment and wages were the controlling factors, the chances are that one or the other or both functional groups would attract workers as frequently as the functional group from which they came. In actuality, however, there is a distinct pattern favoring mobility to industries in the same functional group from which workers came. The unweighted averages for the three broad groups show that movers from five of the nine industries filled more of the available jobs in other industries within the same functional group than they did jobs in either of the other functional groups.

Highest Percentage of Available Jobs Entered Were In:	Random Mobility	Actual Mobility Pattern
Same Functional Group	3	5
One Other Functional Group	3	3
Two Other Functional Groups	3	1

In three cases that percentage was exceeded by industries in one other functional group; and in only one instance was the original group exceeded by both the others.

An examination of the four industries which deviated from the predicted pattern (manufacturing, transportation, trade, and finance) reveals some possible explanations. In all four cases, the industry in question shares major occupations with the industries which received larger concentrations of workers, indicating some weakness of the industry categories as proxies for occupational functional groups and suggesting that more of the movers may have stayed within their functional areas than is indicated by the industry data. The closeness of the average percentages between the original and the highest functional groups (especially 29.9% and 30.2% in finance) increase the likelihood that more appropriate data would show the predicted pattern more clearly. Part of the discrepancy is also attributable to the fact that similarity of occupational function is not the only determinant of mobility patterns. Factors such as inter-industry wage and unemployment differentials do influence the pattern. Despite the exceptions, however, these data support the proposition that a Functional Classification of Occupations reflects actual manpower mobility patterns.

This evidence is all the more noteworthy because the data report only the most dramatic moves, those where the job change also involves a change of industry, while they completely obscure intra-industry and intra-firm changes which are even more likely to involve intra-functional or intra-cluster changes.

In another study, an analysis of Stanford University graduates, Ann Roe found that occupational changes are not random, but are positively associated with the Roe classification groups to which the original occupation belongs.[14] Her analysis showed considerable variation among the various occupational groups, and although, her sample is not representative, the statistical significance of her results and the similarity of her groups to the Functional Classification of Occupations groups provides some additional evidence that such categories are real categories in the occupational structure.

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[14] Ann Roe and Thomas Hutchinson, "Studies of Occupational History: Part III. The Stability of Occupational Groups of the Roe System," Journal of Counseling Psychology, XVI, No. 5, pp. 390-395.

Systematic attention has recently been focused on the institutional mielieu of intrā-firm changes by the work on internal labor markets at Harvard University. The internal labor market model "departs from the conventional view of the labor market by recognizing a market internal to the manufacturing plant which is connected to the external labor market at a limited number of entry ports."[15] That is, recruitment and competition for many positions is limited to internal promotion of persons already employed by the firm, and this practice follows recognizable labor market patterns, but strictly within the firm. Direct competition for jobs from the larger, external labor market is limited to certain "port-of-entry" occupations. Doeringer and Piore's work indicates that an internal labor market model provides an analytically useful way of studying wage determination, job design (especially career ladders), training, and adjustment to technological change as well as the differential impact of external institutions and policies on port-of-entry and strictly internal occupations. A Functional Classification of Occupations provides a data structure which is highly compatible conceptually, and it would likely prove analytically supportive of this line of inquiry.

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[15] [Peter B. Doeringer and Michael J. Piore], "Internal Labor Markets, Technological Change, and Labor Force Adjustment," Work Force Adjustments in Private Industry - Their Implications for Manpower Policy (Manpower Automation Research Monograph, No. 7) (Washington, D.C.: U.S. Department of Labor, Manpower Administration, October, 1968), p. 47.

This capacity to understand the interrelationships of jobs within the labor market is important to an understanding of market functioning and skill development. The intensive specialization of function within firms and industries requires information systems which elucidate these relationships.

> Some understanding of the way in which work is characteristically organized in industry is essential to an appreciation of how workers become skilled as a result of upgrading or changing jobs.[16]

Such an understanding of the intricate structure of career ladders is essential for the success of "new careers" and other manpower programs, as well as for guidance and vocational education, but it is also essential to the understanding of labor market functioning.

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[16] National Manpower Council, A Policy for Skilled Manpower, p. 215.

Scoville's argument in favor of a "job family" classification applies here. He argues that:

> . . . the job families and levels of content and complexity are at least partial determinants of income, training requirements, and the rest. A model based on job content should be preferred for its generality in this sense, that it is based on the underlying fabric of jobs in the economy, which is logically anterior to the resulting characteristics of employment, income and training.[17]

An Analytical Application of a Functional Classification of Occupations: Relative Growth of Economic Sectors

One of the topics of sustained interest to professional economists and the general citizenry is the changing employment profile of the American economy. This topic raises many related issues, including questions of manpower development policy (the optimum level and mix of educational and retraining programs), questions of income distribution (efficient and equitable job allocation and the role of income maintenance programs), and questions concerning the social implications of such changes. A central issue in all of this discussion is, can the economy absorb the growing labor force, given the declining growth rate of employment in goods producing activities? That is, can a service economy provide full employment, and if so under what conditions?

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[17] James G. Scoville, "Making Occupational Statistics More Relevant," 1965 Proceedings of the Business and Economic Statistics Section of the American Statistical Association, p. 320.

Various aspects of this basic issue have been examined many times and in many ways. One of the main currents of this examination has been automation studies, which have attempted to comprehend and project the impact of rising output per man, especially in the goods producing sector. Another major current has been the studies of the so-called "service" sectors of the economy. Of interest here is not the substance or conclusions of those studies, but the prevalant taxonomic and data systems on which they are based. Authors of service sector studies invariably struggle at some lengths with the conceptual and operational definition of their subject. Fifteen years ago George Stigler, in his classic study for the National Bureau of Economic Research, said:

> There exist no authoritative consensus on either the boundaries or the classification of the service industries...
>
> . . . .
>
> The phrase "service industry" connotes economic activity which takes the salable form primarily or exclusively of a personal service rather than a material commodity--the industries which provide material commodities being designated as agriculture, manufacturing,

> construction, and the like. The borderlines of even this simple division are perplexing: it is not evident that a firm assembling purchased parts creates material commodities in a manner different from a restaurant preparing and serving food, although the Census calls the former establishment manufacturing and the latter trade.[18]

Very recently Victor Fuchs, continuing the National Bureau of Economic Research's examination of service industries in a book called The Service Economy, reaches the same conclusion. He says that subsequent studies provide no basis for challenging Stigler's conclusion.[19]

In Fuchs' own attempt to define a service industry sector, he follows the common practice of including wholesale and retail trade, finance, insurance, real estate, general government, and professional, personal, business and repair services. He observes, however, that "there is much heterogeneity to be found in this sector,"[20] and he devotes part of his book to an exploration of this heterogeneity.

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[18] George J. Stigler, Trends in Employment in the Service Industries (National Bureau of Economic Research, No. 59, General Series) (Princeton, N. J.: Princeton University Press, 1956), p. 47.

[19] Victor R. Fuchs, The Service Economy (National Bureau of Economic Research, No. 87, General Series) (New York: National Bureau of Economic Research, 1968), p. 14.

[20] *Ibid.*, p. 16.

Another inquiry, this time into the specialized portion of services designated as "producer services," runs into a similar problem. In that examination, Harry I. Greenfield says "In sum, while the total output of our economy can be divided in one sense along the broad lines of goods and services, we have attempted to show that the division is not clear-cut."[21]

Greenfield's interest is in a class of activity which is conceptually similar to that included in technical services in the Functional Classification of Occupations. However, Greenfield's definition is based upon a market distinction between household and firms. That is, he wants to examine those services which are usually provided to producers rather than to final consumers, but his examples are mostly activities which would fall within the Functional Classification of Occupations' technical service group. Greenfield defines producer services employment operationally as three-fourths of transportation, one-fourth of communications, all of wholesale trade, one-half of finance, insurance, and real estate, advertising, and miscellaneous business services, one-half of legal, nine-tenths of engineering and architectural, nine-tenths of accounting, auditing, and bookkeeping, three-fourths of miscellaneous professional services, and one-third of government.[22]

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[21] Harry I. Greenfield, Manpower and Growth of Producer Services (New York and London: Columbia University Press, 1966), p. 10.

Several things are evident from these examples. One is that a dichotomous distinction between goods production and service is conceptually difficult, leaving service as a heterogeneous grouping of activities which serve different functions and different markets. An operational definition is difficult when only industry data are available and becomes extremely difficult when one attempts, as Greenfield does, to examine a particular component of the service sector with only broad industry division data. This lack of appropriate data has undoubtedly been contributory if not responsible for the more common practice of dealing with services as a single though unsatisfactory group, a practice which, Greenfield points out, obscures some very important distinctions. Some of these are distinctions which the Functional Classification of Occupations helps elucidate, and the recognition of those distinctions might temper the frequently pessimistic conclusions of inquiries of this sort. Though the studies cited previously are more analytical and better documented, Heilbroner's Manpower Seminar statement on "Automation in Perspective of Long-Term Technological Change,"[23] is a clear and direct statement of a common line of reasoning on this subject. Essentially Heilbroner's thesis is as follows. Historically there have been systematic shifts within the American economy. In 1800, roughly 70-80 percent of the labor force were farmers, with the remainder spread between handling goods and providing services. By 1900, only about half that many were engaged in farm related activities, while about 40 percent were in the goods handling sector (mining, manufacturing, transportation, construction) and 25 percent were engaged in providing services. At mid-century only about 8 percent of the labor force was on the farm (it is even lower now), about 40 percent were in the goods sector, and over half were in the service sector. Heilbroner attributes the shifts out of agriculture to technological progress in a sector characterized by inelastic demand. The goods producing sector also failed to expand its share of employment during the first half of the Twentieth Century, despite numerous demands creating inventions such as automobiles, television, and the like. Heilbroner attributes this lack of growth to the compensating effects of mechanization, and this history makes him pessimistic about the goods producing sector's future growth potential. He attributes the recent rapid growth of the service sector to demand expansion not accompanied by significant incursions of productivity-enhancing technology. Heilbroner's principal thesis is that we have now reached the stage where technology is making its entrance into the service sector. Heilbroner's conclusion: "If it is true that there is this underlying trend of technology into the service occupations, it bears a very important implication for the future. It means that the last sector of the market economy has been, so to speak, preempted by machinery and that there is now no expansive market sector left."[24]

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[22] *Ibid.*, p. 22.

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[23] Robert L. Heilbroner, Automation in the Perspective of Long-Term Technological Change (Seminar on Manpower Policy and Program)([Washington, D.C.]: U.S. Department of Labor, Manpower Administration, December, 1966).

Indeed, recent employment projections from the Bureau of Labor Statistics tend to show the continuation of the historical decline of agriculture and relative stability of goods production which Heilbroner described. Table 10 shows the projected 1960 to 1975 employment growth patterns for the major S. I. C. Industry Divisions grouped into goods producing and service sectors as Heilbroner and others have done.

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[24] Ibid , p. 14.

TABLE 10

TOTAL NATIONAL EMPLOYMENT, BY INDUSTRY AND INDUSTRIAL SECTORS, 1960 AND PROJECTED 1975

Industry	1960 Employment	Projected 1975 Requirements	Percent Change 1960-1975
Total, All Industries	66,681	88,660	+33%
Production Industries	32,452	36,205	+12
Agriculture, Forestry and Fisheries	5,816	3,875	-33
Production except Agriculture, Forestry and Fisheries	26,636	32,330	+21
Mining	723	640	
Contract Construction	4,068	5,675	
Manufacturing	17,307	20,625	
Transportation-Communications and Public Utilities	4,538	5,390	
Service Industries	34,229	52,455	+53
Wholesale and Retail Trade	13,365	18,455	
Finance, Insurance, and Real Estate	2,852	3,980	
Service	14,794	24,880	
Public Administration	3,218	5,140	

Source: U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. IV (Bulletin No. 1606), Appendix C.

A companion set of occupational projections makes the historical point even more emphatically, but leads to some tempering of conclusions with regard to employment prospects in service. Detailed occupational data published by the Bureau of Labor Statistics were classified into the occupational clusters and then into the broad functional groups of the Functional Classification of Occupations.[25] Results presented in Table 11 show almost no expansion in production occupations during a period when overall employment is projected to increase one-third. Consistent with Heilbroner's analysis, agriculture, which is included here within the production sector, shows a continued sharp decline while the rest of the goods producing clusters show a growth rate that is substantially below par. These data also show that goods production makes up far less than half the employment, though it is the largest single activity. Thus the occupational data in Table 11 make the point much more emphatically than the industry data presented in

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[25] Data in Table 2 are compiled from detailed occupational data based on the Census and on industry employment estimates using the industry-occupational matrix method and adjusted by the Bureau of Labor Statistics on the basis of independent special purpose occupational studies. Several Census--Bureau of Labor Statistics "N. E. C." categories are classifiable only at the broad, functional level. Complete tabulations of the occupational detail are included in the Statistical Appendix. A complete statement of methodology and assumptions appears in the source document, Tomorrow's Manpower Needs, Vol. IV.

TABLE 11

NATIONAL EMPLOYMENT IN OCCUPATIONAL CLUSTERS AND FUNCTIONAL GROUPS, 1960 AND PROJECTED 1975

	1960 Employment (in thousands)	Projected 1975 requirements (in thousands)	Percent of Total, 1960	Percent Change 1960-1975
Total, All Occupations	66,681	88,660	100	+33
I. Organization Management Functional Group	16,489	23,538	25	+43
11 Administrative Occupations	7,000	9,022		
14 Clerical Occupations	6,979	10,461		
16 Bookkeeping-Accounting Occupations	2,510	4,055		
II. Technical Services Functional Group	7,777	12,616	12	+62
21 Social Research and Planning Occupations	146	207		
23 Engineering and Design Occupations	1,118	1,953		
26 Laboratory Science Occupations	377	858		
31 Mechanical Occupations	2,168	3,350		
34 Building Maintenance Occupations	3,041	4,052		
Unclassifiable Technical Occupations	927	2,196		
III. Production Functional Group	24,227	25,754	36	+ 6
41 Agricultural and Forestry Occupations	5,395	3,352		-38
42 Construction Occupations	2,285	2,728		+19
43 Food Processing Occupations	293	320		
44 Textile and Apparel Occupations	1,231	1,468		
47 Graphic Arts Occupations	419	503		
56 Electricity and Electronics Occupations	303	427		
54 Metal Working Occupations	2,530	3,053		
59 Other Production Occupations	484	465		
Unclassifiable Production Occupations	11,287	13,438		
IV. Distribution Functional Group	10,511	14,275	16	+36
61 Transportation Occupations	3,087	4,020		

TABLE 11--Continued

	1960 Employment (in thousands)	Projected 1975 requirements (in thousands)	Percent of Total, 1960	Percent Change 1960-1975
71 Stock Control Occupations	1,273	1,679		
74 Sales Occupations	4,401	5,906		
78 Food Service Occupations	1,750	2,670		
V. Direct Service Functional Group	7,685	12,480	11	+62
81 Health Services Occupations	1,840	3,355		
84 Social Services Occupations	2,492	3,881		
94 Protective Services Occupations	766	1,183		
93 Art and Entertainment Occupations	470	774		
Unclassifiable Service Occupations	2,117	3,287		

Note:

Because of rounding, sums of individual items may not equal totals.

Source: Compiled from U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. IV (Bulletin No. 1606), Appendix E.

Table 10 which temper the pattern with the inclusion of administrative, sales, maintenance, and other employees with actual production workers in goods producing industries.

Table 11, however, also brings into question the appropriateness of a single generalization about a service sector that includes everything other than goods production. Data in that table appear in five major functional categories, and they indicate that direct services and technical services are expanding at about twice the average rate, while distribution activity shows a growth rate very close to the overall average, and administrative activities are growing at a slightly faster than average rate. Any single statement regarding those various groups requires a kind of aggregating which borders on over-simplification.

Returning to Heilbroner's point, it is apparent that there are dramatic examples of the application of labor saving technology outside of goods producing activities. Heilbroner cites two: the introduction of check reading equipment in banking, and the substitution of vending machines for a snack bar in a recreation facility. Applying a functional classification, it becomes apparent that neither example represents mechanization in direct service. The first example is one which would affect the clerical cluster in the organizational management functional group, and the second would affect food service occupations in the distribution group; neither example comes from either of the two fastest growing areas of direct service and technical service. Moreover, the application of computer systems and other types of technology to clerical and record-keeping activities, the palletizing of stock and the introduction of more self-service marketing in the distribution of goods, which are some of the most likely areas for further labor saving technological and organizational changes, are again innovations which would affect the slower growing organization management and distribution activities, and would not substantially affect either direct service or technical service activities. This is not to say that these activities are immune to labor saving changes in either technology or organization; in fact there is a growing opinion that health and social service delivery need substantial increases in productivity. The point is, rather, that the Functional Classification of Occupations demonstrates the hazards of generalizing about a service sector which encompasses everything outside of production activities. The obscuring of organizational management and technical service activities can hardly be avoided with industry data, because most such activities are performed within firms best classified as producers, distributors, or service vendors. But even with industry data it is possible to distinguish distribution from service, and making the distinction significantly alters the conclusions of analyses such as Heilbroner's.

This analytical examination shows that the Functional Classification of Occupations permits an even more informative examination of the distinct growth patterns of the three fundamental functions of production, distribution, and service while at the same time recognizing the significance of management and technical service activity for manpower developments.

Growth of Technical Services

In the foregoing discussion, considerable emphasis was placed on the differential growth rate of production, distribution, and direct service activities, though mention was made of Greenfield's attempt to isolate and to analyze producer services (which, as noted, have their rough counterpart in the Functional Classification of Occupations' technical services functional group). The growth of such technical services is indeed a significant development. Table 11 shows it to be one of the two fastest growing functional areas. By 1975 technical services will engage nearly as many employees as either distribution or direct service. Nevertheless, as Eli Ginzberg points out in his introduction to Greenfield's study of producer services, the service sector generally has not received much detailed study, and the technical services have received even less attention than the direct services.

The technical service occupations are recognizable as a distinct group, according to the Functional Classification of Occupations, because of their distinct economic function. The separate classification of these occupations is also analytically significant, because the technical service occupations violate the service sector stereotype of high proportions of females, low pay, and a predominance of personal contact in the work activities. Greenfield demonstrates that in producer service industries (his rough counterpart of the technical services functional group) there is in fact a low percentage of female employees, pay is relatively high, and the group shows not only a strong growth trend but also persistently low unemployment.[26] Such distinctions obviously have implications for educational and manpower policy as well as for general economic policy.

The analytical utility of the technical service functional group as well as the organizational management functional group is illustrated by an earlier study by Samuel Hill and Frederick

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[26] Harry I. Greenfield, Manpower and the Growth of Producer Services (New York and London: Columbia University Press, 1966).

Harbison, wherein they attempted to identify and to ascertain the reasons for the increasing employment of highly skilled manpower. In their study, which was based upon surveys of 50 firms in 18 two-digit S. I. C. industry groups, the authors defined seven occupational categories: executive, administrative, professional, technical, sales, clerical, and a residual production category. The authors found the reasons for the rapid growth in the various non-production categories in new products and production processes and in such administrative innovations as decentralized administration, research and development activities, and accounting functions. Despite the difficulty of predicting innovation the authors conclude that the relatively rapid growth of these particular non-production personnel is likely to continue.[27]

The already substantial size of the technical service functional group together with its present and expected rapid growth rate make it an appropriate subject for much more extensive analysis than has heretofore been done. The ability of a Functional Classification of Occupations to identify this significant category of occupations and to permit analysis of the distinctive manpower profile of this category is indeed a merit. The brief examination of functional employment distributions and growth patterns indicate the analytical power of a Functional Classification of Occupations. This alternative also raises serious questions about the data structures by which such topics are usually analyzed; furthermore it suggests a significantly different set of conclusions.

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[27] Samuel E. Hill and Frederick Harbison, Manpower and Innovation in American Industry (Princeton, N. J.: Princeton University, Industrial Relations Section, 1959).

TABLE 12

STATISTICAL APPENDIX: CLASSIFICATION OF DETAILED NATIONAL OCCUPATIONAL DATA INTO A FUNCTIONAL CLASSIFICATION OF OCCUPATIONS

Functional Groups (I-V), Clusters (11-98), and Occupations	National Employment in 1960 (in thousands)	Projected 1975 Requirements (in thousands)
I. Organization Management Functional Group		
11 Administrative Occupations	7,000	9,022
Managers, Officials and Proprietors, not elsewhere classified	6,785	8,667
Purchasing Agents	115	164
Personnel and Labor Relations Workers	100	191
14 Clerical Occupations	6,979	10,461
Stenographers, Typists, and Secretaries	2,386	3,900
Telephone Operators	355	452
Clerical and Kindred Workers, not elsewhere classified	4,238	6,109
16 Bookkeeping-Accounting Occupations	2,510	4,055
Accountants and Auditors	429	660
Bookkeepers, hand	667	900
Accounting Clerks	383	470
Cashiers	479	973
Creditmen	50	89
Bank Tellers	127	263
Office Machine Operators	375	700
II. Technical Services Functional Group		
21 Social Research and Planning Occs	146	207
Economists	17	31
Statisticians and Actuaries	23	36
Other Social Scientists	6	12

TABLE 12--Continued

Functional Groups (I-V), Clusters (11-98), and Occupations	National Employment in 1960 (in thousands)	Projected 1975 Requirements (in thousands)
Opticians and Lens Grinders	20	25
Other Mechanics and Repairmen	1,033	1,810
34 Building Maintenance Occupations	3,041	4,052
Janitors and Sextons	625	980
Charwomen and Cleaners	200	372
Private Household Workers	2,216	2,700
Unclassifiable Technical Services Occs.	927	2,196
Professional, Technical and Kindred Workers, not elsewhere classified	502	1,276
Technicians, Other	425	920
III. Production Functional Group		
41 Agriculture and Forestry Occs.	5,395	3,352
Farmers and Farm Workers	5,395	3,352
42 Construction Occupations	2,285	2,728
Carpenters	832	900
Brickmasons, Stonemasons, and Tile Setters	186	228
Cement, Concrete Finishers	46	75
Electricians	360	450
Painters and Paperhangers	416	455
Plasterers	50	61
Plumbers and Pipefitters	304	425
Roofers and Slaters	50	69
Glaziers	16	30
Asbestos and Insulation Workers	20	29
Blasters and Powdermen	5	6
43 Food Processing Occupations	293	320
Bakers	103	97
Meat Cutters, except Meat Packing	190	223

TABLE 12--Continued

Functional Groups (I-V), Clusters (11-98), and Occupations	National Employment in 1960 (in thousands)	Projected 1975 Requirements (in thousands)
44 Textile and Apparel Occupations	1,231	1,468
Knitters, Loopers, and Toppers	44	44
Spinners, Textile	50	31
Weavers, Textile	61	41
Sewers and Stitchers, Mfg.	625	824
Upholsterers	59	78
Laundry and Dry Cleaning Operators	392	450
47 Graphic Arts Occupations	419	503
Designers, except Design Draftsmen	66	116
Photographers	51	57
Compositors and Typesetters	183	155
Electrotypers and Sterotypers	9	5
Engravers, except Photoengravers	11	15
Photoengravers and Lithographers	24	55
Pressmen and Plate Printers	75	100
56 Electricity and Electronics Occs.	303	427
Linemen and Servicemen	286	400
Radio Operators	17	27
54 Metal Working Occupations	2,530	3,053
Molders, Metal except Coremakers	54	56
Patternmakers, Metal and Wood	40	49
Rollers and Roll Hands	32	34
Furnacemen, Smeltermen, and Pourers	52	56
Heaters, Metal	7	9
Toolmakers and Diemakers	180	221
Machinists and Related Occupations	491	504
Blacksmiths, Forgemen and Hammermen	34	24
Heat Treaters, Annealers	20	22
Machine Tool Operators, class B	259	256
Electroplaters	12	15
Electroplaters Helpers	20	22
Inspectors, Metalworking, class B	179	210

TABLE 12--Continued

Functional Groups (I-V), Clusters (11-98), and Occupations	National Employment in 1960 (in thousands)	Projected 1975 Requirements (in thousands)
Sheet Metal Workers	137	183
Welders and Flame Cutters	355	575
Structural Metal Workers	65	105
Boilermakers	24	27
Assemblers, Metal Working, class A	101	140
Assemblers, Metal Working, class B	468	545
59 Other Production Occupations	484	465
Mine Operators and Laborers, not elsewhere classified	281	200
Inspectors, Other	96	141
Power Station Operators	21	24
Inspectors, Log and Lumber	20	25
Cabinetmakers	66	75
Unclassifiable Production Occupations	11,287	13,438
Foremen, not elsewhere classified	1,137	1,650
Craftsmen and Kindred Workers, not elsewhere classified	531	730
Operatives and Kindred Workers, not elsewhere classified	5,954	7,280
Laborers, except Farm and Mine	3,665	3,778
IV. Distribution Functional Group		
61 Transportation Occupations	3,087	4,020
Airplane Pilots and Navigators	29	55
Air Traffic Controllers	12	13
Conductors, Railroad	43	44
Drivers, Bus, Truck, and Tractor	1,774	2,325
Deliverymen and Routemen	601	845
Officers, Pilots, and Engineers, Ship	35	36
Locomotive Engineers	47	50
Locomotive Firemen	42	7
Brakemen and Switchmen, Railroad	103	111
Sailors and Deckhands	32	27

TABLE 12--Continued

Functional Groups (I-V), Clusters (11-98), and Occupations	National Employment in 1960 (in thousands)	Projected 1975 Requirements (in thousands)
Excavating, Grading, and Road Machinery Operators	245	335
Cranemen, Derrickmen, and Hoistmen	124	172
71 Stock Control Occupations	1,273	1,679
Librarians	80	130
Postmasters and Assistants	39	34
Mail Carriers	206	290
Postal Clerks	243	340
Shipping and Receiving Clerks	325	365
Attendants, Automobile Service and Parking	380	520
74 Sales Occupations	4,401	5,906
Sales Workers	4,401	5,906
78 Food Service Occupations	1,750	2,670
Bartenders	172	233
Cooks, except private households	557	860
Counter and Fountain Workers	158	320
Waiters and Waitresses	850	1,225
Airline Stewards and Stewardesses	13	32
V. Direct Service Functional Group		
81 Health Service Occupations	1,840	3,355
Dentists	87	125
Optometrists	17	20
Osteopaths	13	16
Physicians and Surgeons	221	374
Veterinarians	19	26
Pharmacists	114	126
Dieticians and Nutritionists	27	37
Nurses, Professional	496	860
Nurses, Practical	225	465
Attendants, Hospital and Other Institutions	450	1,083

TABLE 12--Continued

Functional Groups (I-V), Clusters (11-98), and Occupations	National Employment in 1960 (in thousands)	Projected 1975 Requirements (in thousands)
Other Professional, Technical and Kindred Medical and Health Workers	171	223
84 Social Service Occupations	2,492	3,881
Psychologists	17	40
Social and Welfare Workers	105	218
Clergymen	200	240
Lawyers and Judges	225	320
Teachers, Elementary	978	1,233
Teachers, Secondary	603	1,100
Teachers, College	206	455
Teachers, Other	158	275
94 Protective Service Occupations	766	1,183
Policemen and Other Law Enforcement Officers	287	518
Firemen	148	250
Guards, Watchmen, and Doorkeepers	331	415
98 Art and Entertainment Occupations	470	774
Professional, Technical and Kindred Workers in the Arts and Entertainment	470	774
Unclassifiable Service Occupations	2,117	3,287
Service Workers, not elsewhere classified	2,117	3,287

Note: Because of rounding, sums of individual items may not equal totals.

Source: Compiled from U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. IV (Bulletin No. 1606), Appendix E.

CHAPTER VII

SUMMARY

There is a widespread and growing need for information about occupations and about the manpower consequences of basic economic changes. Effective utilization of present or additional information, however, requires conceptually, operationally, and analytically useful data classification systems. Even though existing classification systems are inadequate for many important research and program needs, there has been little systematic study and no consensus regarding either the general outlines or the specific details of a standardized occupational classification system. The diversity of interests in occupations probably accounts for this lack of agreement. Nevertheless, a standardized, general purpose occupational classification system would reduce the cost of generating occupational data and would enhance communcation among data producers and data users.

Major Needs for Occupational Data

An examination of five major uses of occupational data reveals a surprising degree of concurrence in their data needs.

Accuracy.--Turning first to the question of accuracy, it appears that extreme accuracy is not essential for most purposes. Only specific vocational training and specific industrial location and wage studies require great accuracy; while general policy considerations, vocational guidance, most occupational curriculum planning, and even most special purpose studies and projects can be carried on with moderately accurate data.

Detail.--Just as extreme precision proves not to be an overriding consideration, there is little reason to think that extremely detailed data are required for most purposes. Of the several uses discussed, only industrial location and wage decisions and some very specific vocational training appear to require finely detailed data. It is noteworthy that these are the same uses which require precise data, and they are also the uses which most require geographically specific data. Such needs may require specific local studies as supplements to a general purpose data system. As for the other uses of occupational data, the need for detail is much less critical. Many needs apparently could be met by a few very broad categories, and most could be satisfied with an intermediate level of detail. These needs include early vocational counseling, much curriculum planning, nearly all manpower policy considerations, and even many manpower studies.

Considering the needs for various levels of detail, it seems reasonable to conclude that a three-level system would be most satisfactory. Such a system would consist of several hundred occupational categories which would be specific enough to show considerable homogeneity of job duties, but broad enough to include substantial employment. (These could be supplemented by "occupational specialties" where highly detailed information is required.) At the next higher level would be an intermediate classification consisting of 20 to 30 categories, which would seem to be appropriate for a variety of purposes. Finally, the classification system would be summarized into a few broad groups, a level which would facilitate broad understanding of occupational characteristics and trends.

Classifying Principle.--The most difficult question remains, namely what classifying principle is to be used in constructing the various categories. There seems to be a consensus that the detailed categories are best defined in a conventional way, in terms of work performed. At the broader, analytical levels, characteristics of the job still seem to be relevant for industrial location and wage studies, for much policy making, curriculum planning, and many special purpose studies, and, to some extent, for vocational guidance. However, there is no agreement upon which characteristic of the job is most relevant, and there is considerable need for information classified in terms of the characteristics of persons filling the position, especially in vocational guidance.

Existing Classification Systems

An evaluation of existing occupational data classification systems in terms of their usefulness for these various purposes reveals no generally applicable system. Existing systems are of three general types--socio-economic, worker traits, and curriculum areas.

Socio-Economic Systems.--The presently used socio-economic systems, of which the Census and the Dictionary of Occupational Titles are the best known and most widely used, have come under widespread criticism for being conceptually vague and inappropriate for many analytical needs. They are also difficult to apply operationally.

Worker Trait Systems.--Many of the alternatives to the socio-economic systems rely on worker traits rather than job duties as a basis for classifying occupations, with most of them being based on either aptitudes or interests. Grouping occupations on the basis of the most prominent aptitudes, however, leaves groups which are so diverse in job duties and skills that descriptive, occupationally based group titles cannot even be assigned.

Interest classifications come much closer to meeting the various needs for occupational data, but one of the greatest problems with interest classification systems is the extremely disparate size which would appear once employment was classified on this basis. Several categories in the various interest classification systems would contain very few occupations, while a single group would contain the vast majority of employment in the production, movement, and storage of goods. Worker trait systems seem mostly not to satisfy the variety of needs for analytical groupings of occupational data.

In addition there is the fundamental technical problem inherent in worker traits as a classifying principle, that is, the standard to be used in measuring the worker traits of an occupation. There can be substantial differences among observed traits, performance requirements, and the traits desired by employers. These distinctions are important but very difficult to make in practice, because worker traits requirements (hiring requirements) are both more difficult to measure and potentially more flexible than job duties.

Curriculum Area Systems.--A third and rather recent type of occupational classification system is the curriculum area system.

Such a system has little to recommend it, however. It reverses the dependent (curriculum) and independent (occupation) variables; it tends to omit major areas of knowledge and skill which are occupationally relevant; and it implies an absoluteness in the means of occupational preparation which is not the case. Such systems seem to have appeal only in vocational education, and even there curriculum planning can be better served by a system based on job duties.

Of all of the existing types of systems, not one of them showed itself to be satisfactory as a general purpose system. For one thing, none provides the three levels of detail judged necessary for such a system. More importantly, none is based on a classifying principle which meets the criterion of broad usefulness.

It seems however, that a classification system based upon some characteristic of the job is probably more broadly useful, more readily applicable, and more verifiable than any of the others.

"Function" as a Classifying Principle

In reviewing the literature of various data using fields and in studying the literature on occupational classification, one is struck with the frequency with which a common suggestion is made, though not pursued. The term "function" or some similar term appears in statements by writers in many fields with interests in occupational classification. To take an elementary example of the application of the concept of function to occupations, one would say that, in a general economic or social context, the principle function of physicians is to provide health services, which is the same function performed by dentists, registered nurses, dental hygienists, licensed practical nurses, and nurse aides, (the differences between physicians and nurse aides being one of level). Similarly, the function of executives and other officials in most organizations is to provide management control. This context involves standard usage of the term. Webster's New World Dictionary defines function as "a special duty or performance required of the person or thing in the course of work or activity: as, the function of a policeman is to protect and assist the public."

This principle is one which classifies occupations on the basis of job characteristics, but it focuses on the dominant activity, or central job duty, not on an overall skill level or a variable which is of little significance to some occupations.

The classification of actual occupations into a Functional Classification of Occupations yields 20 to 30 "occupational clusters" in five broad functional groups in addition to the detailed occupations and occupational specialties. The resulting system is a rather highly integrated one with the relationships of product flow, market, work place, types of educational requirements and perhaps work attitudes becoming apparent in addition to similarities in job duties.

Advantages of a Functional Classification of Occupations

A Functional Classification of Occupations has a number of conceptual, operational, and analytical advantages.

Conceptual Advantages.--One of the chief conceptual advantages of the system is that it is based on a general principle, that of social or economic "function" which is highly relevant to all occupations. The principle is also one which is readily definable and easily understood. Another major advantage is that this system, while incorporating a new classification variable, uses the existing job duties basis for defining occupations and is therefore perfectly compatible with existing occupational definitions. A functional classification system is also flexible with regard to level of detail, and, while there are a number of occupations which are difficult to classify on the functional basis, the number of such occupations is much smaller and the solutions are much more apparent in the case of the functional classification system than in many other classification systems.

Operational Advantages.--The operational advantages of the Functional Classification of Occupations become apparent from an examination of the sources and methods used in compiling occupational data. The Census shows a 32 percent coding and response error, and data classified according to the DOT show a 15 percent coding error; a functional classification, on the other hand, shows only 2 percent coding error. The Functional Classification of Occupations also has the advantage of being operationally more compatible than socio-economic systems with the new, "industry-occupational coefficients matrix" method of occupational employment forecasting now being implemented by state and national manpower research agencies. Thus, in addition to its several conceptual advantages, the Functional Classification of Occupations has certain operational appeal, especially when applied to establishment data. These operational advantages grow out of the Functional Classification of Occupations' correspondence to the functional organization of occupations in establishments. This correspondence probably accounts for much of the superior performance of the system as judged by the rate of coding error in the one field research test of the system. These operational advantages make the Functional Classification of Occupations particularly attractive as a coding system for establishment data.

Analytical Advantages.--How well does a Functional Classification of Occupations serve the major needs for occupational data? A review of the five major needs for occupational data indicates that it meets the preponderance of those needs, while reflecting the economist's essential interest in occupational and manpower substitutability. Educational field and substitutability among occupations are important for policy formulation, and a Functional Classification co-classifies occupations which share a need for certain types of education. Moreover occupations with traditional, if not technologically determined coefficients, most often have common economic functions and are therefore co-classified in a Functional Classification of Occupations. General purpose occupational data presented in terms of a Functional Classification of Occupations consequently appear quite pertinent for manpower policy considerations, and for analyzing the manpower consequences of other types of policy decisions. Similarily, a Functional Classification of Occupations can readily provide the various levels of detail needed for vocational curriculum planning, and a Functional Classification of Occupations goes further than a curriculum area system in identifying pertinent skills, knowledges, and work attitudes.

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With regard to the needs of vocational guidance, a Functional Classification of Occupations comes much closer than socio-economic classification systems to meeting the occupational information needs, both by avoiding excessive emphasis on status and by revealing categories of occupations which reflect worker traits, as well as types of job duties. The structure of the Functional Classification of Occupations permits the maintenance of a high degree of homogeneity within occupation and occupational specialty categories because it does not require the detailed coding of every single job. This is advantageous for data uses, such as industrial location and wage decisions, which require highly precise and detailed data. In addition, the clusters of the functional system facilitate appropriate wage comparisons and help to identify supplies of manpower, not only in the precise occupations required but in related occupations and industries.

The very diverse interests of special purpose studies and projects preclude the universal applicability of any occupational classification system. It does seem, however, that a Functional Classification of Occupations, by virtue of its applicability to manpower policy and other prominent areas of educational and labor market research, would have some advantages. Similarly, studies in a variety of areas which make only limited recourse to occupational data would seem to find the broad functional groups quite analytically useful.

A Functional Classification of Occupations, though a departure from historical data classification, is consistent with the comparability requirements of much research, because the Functional Classification and the existing classification systems are the same at the definitional, detailed occupational level. Moreover, a Functional Classification of Occupations would increase the compatibility between occupational employment and other social statistics, a feature which is now largely lacking in socio-economic series.

When applied briefly to several analytical issues, data classified according to a Functional Classification of Occupations seem to have considerable analytical power. A functional classification is complementary to analysis of manpower substitutability, and it would likely prove analytically supportive of the current inquiry into internal labor markets. In addition, a statistical analysis of mobility patterns of male workers supports the proposition that a Functional Classification of Occupations reflects actual manpower mobility patterns.

A Functional Classification of Occupations also proves to have analytical power in examining the relative growth of production, distribution, and service activities and in the growth of technical activities. An analysis of national employment data for 1960 and projections to 1975 shows that the Functional Classification of Occupations permits a more informative examination of the distinct growth patterns of the three basic functions of production, distribution, and service, while at the same time recognizing the significance of management and technical service activity for employment growth. These data reveal that direct service and technical service are the two fastest growing functional groups, and the analysis results in a much more optimistic conclusion regarding the employing potential of the American economy than is seen in many such analyses.

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